EXPLORING INFANTS’ COOPERATIVE PARTICIPATION IN EARLY SOCIAL ROUTINES

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ABSTRACT

Cooperation and joint actions are often investigated in terms of how individuals explicitly coordinate their plans and intentions to achieve a shared goal. However, goals may also be achieved without prior arrangements, when, for instance, an individual takes part in someone else’s action without an explicit agreement, helping that action to be performed. Participating in social interaction may be considered as a basic form of cooperation that does not always require verbal communication or the ability to predict the other’s intentions. Rather, it is based on daily experiences of interacting and coordinating with others in many, different situations.

Framed in this way, cooperative participation can be explored even in those who do not possess high mental abilities, such as infants. Indeed, infants seem to have a natural motive to engage in social interactions (Trevarthen, 1979\(^1\)). How does this participation develop from early forms of social interactions in infancy, to more complex types of interactions later on? Are there early forms of interactive participation in infancy that can be described as supportive for the caregivers’ action? The aim of the present Ph.D. work is to explore the way in which infants participate in daily routines, through the observation of

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3-months-old infants’ behaviour in familiar interactions and their response to violations of these routines.

Chapter two presents a critical reflection, developed with Hanne de Jaegher, on inferential, representational accounts of cooperation by analytical philosophy and experimental psychology. A theoretical reconceptualization of cooperative interactions as social encounters is proposed, framed within the theoretical tenets of enactivism.

Chapter three investigates the structure and function of early social games, considered as early contexts for participation in distributed actions. Through behavioural observations, this study suggested that changes in the multimodal format of the play routines affected the infant’s behaviour and participation in the play interaction.

Chapter four extends the exploration of infants’ cooperative participation in joint routines, observing infants’ behaviour when being picked up. Infants showed specific cooperative adjustments of the body to complement the mother’s action when being picked up, as opposed to un-supportive loss of bodily tension and head strength when the pick-up action was delayed. Participation in this joint routine thus appeared to be conditional to aspects of timing and recognition of the mothers’ movements in the sequence, without relying on inferential knowledge.

Chapter five focuses on intrusiveness, a maternal behaviour that has been described as strongly affecting the infant’s participation in early interactions. In a joint work with Laura Galbusera, a qualitative microanalysis was applied to explore the sequential organisation of mother-infant exchanges to investigate 1) the consistency of current behavioural descriptions of intrusiveness and 2) their efficacy in analysing the interactional dynamics which may restrict the infant’s participation in interaction. A microanalysis inspired by Conversation Analysis methods revealed that interactional dimensions such as
persistency, alignment, sequential structuring and timing appeared to be essential elements for the interactional organisation and the shaping the possibility for the infant’s participation.

The sixth and final chapter summarises the findings emerged throughout the thesis and discusses some key features of infants’ cooperative participation.

By integrating different approaches investigating intersubjective encounters, such as Enactivism, Conversation Analysis and Infant Research, this dissertation has explored cooperation as an aspect of social participation that evolves within human interactions, but is also already grounded in infants’ interactional competencies. This comprehensive approach has provided much needed insight into the importance of widening the concept of cooperation and its development, considering joint routines as multimodal contexts in everyday life where infants (but also adults) learn to understand, make sense of, and align with the other’s actions and affects, without relying on inferential processes.
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DECLARATION

This work is supported by the Marie-Curie Initial Training Network, “TESIS: Towards an Embodied Science of InterSubjectivity” (FP7-PEOPLE-2010-ITN, 264828). Whilst registered as a candidate for the above degree, I have not been registered for any other research award. The results and conclusions embodied in this thesis are the work of the named candidate and have not been submitted for any other academic award.

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DISSEMINATION

Publications


Conference presentations


1. GENERAL INTRODUCTION

The ability to cooperate has received increasing attention over the past years, particularly by researchers from analytical philosophy, developmental and comparative psychology. Cooperation has been described as the “coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem” (Teasley & Roschelle, 1993), or, more basically, as consisting in “i) acting or working together and ii) a common or the same end or purpose” (Tuomela 2000, p. 3). One of the reasons why cooperation has been considered such an important topic in the past two decades, is its role in exploring differences between humans and other animals (especially great apes) (Tomasello, 2009). Moll and Tomasello (2007) have argued that “among primates, humans are by far the most cooperative species, in just about any way this appellation is used [in] cooperative institutions and social practices with shared goals and differentiated roles” (p.1). From a developmental point of view, it is relevant to investigate how cooperation develops. How do we, as humans, learn to support each other and participate in cooperative interactions?

On the one hand, developmental research during the ‘70s and ‘80s has mostly focused on the cooperative aspects of language acquisition in early face-to-face mother-infant interactions (Bruner, 1977; Trevarthen, 1979), yet has paid little attention to how infants cooperatively participate in other kinds of early structured routines. On the other hand, current developmental research on cooperation has restricted its exploration to a range of pre-defined situations, e.g. problem solving tasks, where understanding the other’s intentions is necessary to accomplish a joint goal. In other words, cooperation is seen as
based on a primarily inferential ability (see, for example, Brownell et al., 2006). However, an inferential and strictly cognitive account may not be the most adequate framework to study how cooperation emerges in typical and atypical developmental trajectories. As Butterfill (2012) argues, “we need a further account of joint action, one that is compatible with the premise that joint action plays a role in explaining how humans develop abilities to think about minds” (p.24).

The work presented in this thesis integrates the definition of cooperation arising from infant research “that each of the subjects is taking account of the other's interests and objectives in some relation to the extrapersonal context, and is acting to complement the other's response” (Hubley & Trevarthen, 1979, p. 58), with the ethnomethodological view of cooperation as an intrinsic element of the process of interacting, where “each party builds upon structure provided by others” (Goodwin, 2013, p. 17). The overarching aims of this thesis are 1) to develop a non-inferential view on cooperation; and 2) to explore how infants become cooperative participants in contexts of natural co-actions with their caregivers, namely, joint routines. The framework chosen for this investigation combines an observational method with a dynamical systems approach, by applying microanalytical behavioural observations. As a result, selected behaviours of the infants and the mothers were coded and compared, along with multidimensional, qualitative descriptions of mother-infant interactions.

Chapter two presents a joint theoretical work with Hanne de Jaegher2, which challenges mainstream inferential accounts calling for a more embodied view of

2Dr. Hanne de Jaegher is a philosopher and postdoctoral researcher at the University of the Basque Country, San Sebastian, Spain. Chapter 2 is the result of our collaboration for a publication in which she is co-author (please see Dissemination section).
cooperation. Integrating an enactive theoretical framework with central tenets of ethnomethodology, the work describes situations in which cooperating is not simply an individual behaviour, but also a basic interactional requirement. It then moves on with presenting findings from studies demonstrating basic cooperative participation in individuals with difficulties in mind-reading (especially infants or children with autism). In the conclusions, it is proposed that cooperation is a form of participating in each other’s sense-making; a way of being with others that we, as human, learn along the way, which does not require an *a priori* knowledge of the other’s intentions.

In chapter three and four cooperative participation is specifically investigated through two observational studies on 3-months-old infants engaged in a joint routine with their mothers, and the effects of its violation. The first study describes early familiar nursery-rhymes games as played multi-modally (voice and gestures together) or unimodally. The results show that infants decreased their participation when the game format was altered, that is, when the auditory and motor modalities were separated, suggesting that infants’ participation is conditional to the recognition of the game as an integrated unit of sound and gestures. The second study investigates infants’ behaviour during pick-up interactions, either performed normally or with a short delay after the action has started. The findings suggest that online adjustments are contingently performed already at 3 months of age, supporting and complementing the maternal actions. At the same time, when the pick-up flow is delayed and the mother’s action becomes unintelligible, infants decrease their bodily support and cease to participate in the interaction.
Chapter five is a joint study with Laura Galbusera\(^3\), in which we explore and discuss the behavioural category of intrusiveness as deployed in studies on postpartum depression. Intrusiveness has been generally described in terms of maternal behaviours which restrict the infant’s participation. A microanalysis of five episodes of mother-infant interactions, informed by Conversation Analysis methods, aimed at identifying features of mother’s interactional conduct facilitating vs. hampering reciprocity and attunement. The microanalysis reveals that interactional dimensions such as persistency, responsivity, sequential parsing and timing are essential elements affecting the quality of interaction. Looking at these aspects may be more revealing of the ways in which infants and mothers (with or without a diagnosis of depression) interact, than adopting a pre-defined set of descriptors to define maternal behaviour as intrusive.

The question of how cooperative participation develops in infancy is discussed in chapter six, drawing on the findings and reviews presented in the thesis. Three aspects are specifically considered and discussed: the interactional organisation, multimodality and predictability.

The findings from this work constitute one of the first explicit attempts to describe the development of early cooperative participation in infants. By integrating different approaches investigating intersubjective encounters, such as Enactivism, Conversational Analysis and Infant Research, this dissertation has explored cooperation as an aspect of social participation that evolves within human interactions, but is also already grounded in infants’ interactional competencies. This comprehensive approach has provided much

\(^3\)Laura Galbusera is a TESIS Early Stage fellow at the University Clinic in Heidelberg. This chapter is the result of our intense collaboration during my secondment at the University Clinic in Heidelberg in 2013.
needed insight into the importance of widening the concept of cooperation and its development, considering joint routines as multimodal contexts in everyday life where infants (but also adults) learn to understand, make sense of, and align with the other’s actions and affects, without relying on inferential processes.
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2. WE CAN WORK IT OUT: AN ENACTIVE ACCOUNT OF COOPERATION

Abstract

The past years have seen an increasing debate on cooperation and its unique human character. Philosophers and psychologists have proposed that cooperative activities are characterized by shared goals to which participants are committed through the ability to understand each other’s intentions. Despite its popularity, some serious issues arise with this approach to cooperation. First, one may challenge the assumption that high-level mental processes are necessary for engaging in acting cooperatively. If they are, then how do agents that do not possess such ability (preverbal children, or children with autism who are often claimed to be mind-blind) engage in cooperative exchanges, as the evidence suggests? Secondly, to define cooperation as the result of two decontextualized minds reading each other’s intentions may fail to fully acknowledge the complexity of situated, interactional dynamics and the interplay of variables such as the participants’ relational and personal history and experience. In this joint work mainstream accounts of cooperation are revisited, calling for an embodied approach that sees cooperation not only as an individual attitude towards the other, but also as a property of interaction processes. Integrating the ethnomethodology view of cooperation as an intrinsic element of the process of interacting, where “each party builds upon structure provided by others” (Goodwin, 2013, p. 17), with key features of enactivism (autonomy, interaction and sense-making), this work broadens the spectrum of cooperative activities, including some very basic ones that can take place before complex communicative abilities are achieved. The issue then is not whether one is able or not to read the other’s intentions, but what it takes to participate in joint action.
From this basic account, it should be possible to build up more complex forms of cooperation as needed. Addressing the study of cooperation in these terms may enhance our understanding of human social development, and foster knowledge of different ways of engaging with others, as in the case of autism.

2.1. Introduction

Despite its extensive exploration by philosophers and psychologists, a clear description and understanding of what makes an activity cooperative is still controversial. This is because cooperation is often described, by mainstream accounts, as depending on high-level social skills, and this, as Butterfill puts it, “already presupposes too much sophistication in the use of psychological concepts” (2012) to be applicable in the investigation of more basic forms of cooperation. Indeed, most of the empirical studies on children’s cooperation are based on inferential and mentalistic theoretical accounts, which may not be the most adequate framework to study how it emerges in typical and atypical developmental paths. The present work challenges these theoretical models and proposes to widen the exploration of what cooperation is, what kind of experiences may support someone’s cooperative participation in joint actions, and how this participation may develop over time. Implications of such a change in perspective for cooperation in infancy and in autism are advanced.

Philosophical accounts of cooperation

Current theories of joint action have attempted to describe cooperation as a phenomenon primarily based on cognitive abilities. These theories depict social encounters (and
cooperative actions) as encounters of minds, where participants have to infer each other’s beliefs and desires to understand and predict the other’s intentions and moves. Central to these theories is the concept of shared intentionality. Many philosophical theories propose that joint actions require the creation of shared (or collective, or joint) intentions\(^4\) (Gilbert, 1989; Bratman, 1992, 1993; Tuomela, 1995; Searle, 1995). Sharing intentions is possible when partners make individual plans for achieving a common goal, and then formulate predictions upon the other's intention to achieve the same goal (Gilbert, 1989, 2000; Bratman, 1992; Tuomela, 1993, 2005; Pacherie, 2006). Shared intentions, according to Bratman, are defined as a set of interrelated individual intentional states. In shared activities, he claims, “each agent intends that the group perform the joint action in accordance with and because of meshing subplans of each participating agent's intention that the group so act” (1992, p. 333). According to this view, a joint activity is the result of a shared intention, and a shared intention is simply a pattern of “interlocking” plan-intentions of the participants about which they have common knowledge. Essentially, for cognitivist philosophical approaches, partners engage in cooperative actions if they are able to infer each other's thoughts and plans, and combine them to build their co-actions in some shared way.

As the interest in exploring joint intentionality and joint actions has grown, further theorization followed the original descriptions of cooperation. Building upon Bratman’s account, for example, Tummolini (2013) suggests that representing one’s own goal and

\(^4\)This work will not go into the debate about specific differences between shared or collective intentionality or other denominations. For an overview of analytic standpoints on the terms, see for instance Schweikard & Schmid, 2013.
those of others from a third-person observational perspective is also a necessary cognitive ability to collaborate, along with mind-reading. Thanks to this allocentric representation of goals (as he names it) individuals are endowed with both “an intention in favour of the joint action and one in favour of a joint mode of reasoning”, which enables them to coordinate in a joint action. Other researchers have attempted to formulate less cognitively demanding accounts of shared intentionality, yet still considering representing intentions at the very ground of any joint action. Sebanz, Bekkering and Knoblich (2006), for instance, proposed that a successful joint action “depends on the abilities (i) to share representations, (ii) to predict actions, and (iii) to integrate predicted effects of own and others’ actions” (2006, p.70).

Because they presuppose the presence of high-level socio-cognitive capacities, standard accounts of cooperation hardly apply to those who do not possess propositional knowledge about others’ intentions, such as young children or animals, and some philosophers have already questioned this assumption. Tollefsen (2005), for instance, has argued that awareness of another’s intention may not depend on inferring it, but on the ability to track intentions-in-action. She argues that attending to each other’s actions provides participants with a shared perceptual space constructed through joint attention dynamics. In this shared space, intentions-in-action are perceptually overt and identifiable so that even young children without a “robust theory of mind” (p. 81) can theoretically engage in cooperative activities. Despite these developmental concerns, the author explicitly avoids addressing how this perspective can be effectively applied from very early in development, by saying that “[p]rior to the first year, young infants are like windowless monads” (p. 80), implying that they cannot yet interact. By stressing the importance of joint attention and social referencing mechanisms (as defined by Tomasello, 1995) for the
building up of a shared space, she neglects the possibility of earlier forms of cooperation, e.g. in infancy. Similarly concerned with understanding the role of joint action in development, Butterfill (2012) proposed to replace the concept of shared intentions with that of shared goals. Sharing a goal, in his view, only requires agents’ goal-directed actions to be coordinated, but does not imply knowledge. This move should make cooperation possible in early development. However, he also claims that possessing a shared goal requires representing goal-directed actions, and the way this is achieved by young children, in his proposal, is not completely clear.

These arguments arguably reflect a general problem with the cooperation research reviewed so far: cooperation is framed in its full-blown, adult form and therefore it is difficult to see how those who do not have high socio-cognitive skills (including representing goal-directed actions) or experience could possibly cooperate. This is the main concern in the present paper.

**Cognitive developmental accounts of cooperation**

Defining what it is to cooperate from a developmental point of view is challenging. Recent developmental research in psychology has endorsed a cognitivist account of shared cooperative activities, suggesting that a major step in children’s social cognitive development occurs when, at around 12 to 14 months, children begin to engage with adults in cooperative activities involving an understanding of interdependent roles (Tomasello et al., 2005), and are generally motivated to help the other to accomplish her role if needed (Moll & Tomasello, 2007). Therefore, in order to cooperate, it seems that “children must be
able to represent, monitor, and regulate both their own and the partner's behavior relative to their relation to a single, common goal” (Brownell & Carriger, 1990, p. 1165).

To empirically investigate early cooperative skills through abilities such as perspective taking and understanding of the other’s intentions and goals, most of the studies on young children have adopted specifically designed lab tasks involving role reversal or simultaneous coordination of movements (Brownell & Carriger, 1990; Warneken, Chen, & Tomasello, 2006; Warneken et al., 2012). In the majority of these studies, successfully performed joint tasks would set the age threshold for attributing cooperative abilities and instrumental helping to children. For example, Brownell et al. (2006) observed children at 19, 23 and 27 months of age engaging in peer cooperative problem solving tasks. In these tasks, each child had to pull simultaneously or sequentially one handle of a wooden box to activate a musical toy mounted on the box. Activating the toy by coordinating each other’s timing and movements would lead to successful performance of the task. The researchers found that one-year-old children coordinated their actions more by coincidence than in a cooperative way, whereas older children appeared to be more actively cooperating towards a shared goal. They took these results to confirm their view that the ability to cooperate depends on “being able to represent and to share goals and intentions with a partner” (p. 806), an ability that, according to the study, could only be seen over the second and third years of life.

Another example is a study in which Warneken and Tomasello (2007) investigated instrumental helping and cooperation in 14-months-olds children. Instrumental helping was defined as providing help to people in completing a task, e.g. to pick up an out-of-reach object, whereas cooperation was measured through a series of cooperative tasks to be resolved jointly, such as retrieving an object from a vertically movable cylinder embedded
in a platform. Their results showed that at 14 months children reliably helped a partner who could not achieve a goal, but cooperated successfully only in tasks demanding low coordination. The authors concluded that “Helping might be easier for children than cooperating because it requires the understanding of what another individual intends to do (…), whereas cooperation requires the ability to form a shared goal and to mesh plans of action toward that goal” (ibid. p. 291). In other words, helping would only require reading another’s intention, whereas cooperation would also require one’s own and the other’s intentions to be co-dependent and converge.

In sum, developmental research has attempted to define the beginning of cooperation by setting tasks based on similar premises, thus designing practical tasks that need not only inferring but also mobilising well-formed intentions to be completed. These premises derive from the mainstream philosophical accounts of cooperative actions, which propose that engaging in a cooperative action requires possessing mind-reading abilities, and abilities to align one’s own intentions and beliefs with the other’s, although milder, less cognitively weighted positions have also been proposed. In the next section some pitfalls of current theoretical and methodological approaches are discussed.

**Methodological and theoretical issues with standard approaches**

To put shared intentionality at the very basis of shared cooperative action raises the question of how humans get to know others' intentions and goals. On the standard accounts, this is done by use of a theory of mind or a simulation mechanism, which is “any cognitive system … that predicts or explains the behaviour of another agent by postulating that unobservable inner states particular to the cognitive perspective of that agent causally
modulate that agent’s behaviour” (Penn & Povinelli, 2008, p. 394). This cognitive system is often thought to be supported by the so-called social brain (Frith & Frith, 2003; Frith 2007).

If intentions are hidden, are joint intentions hidden too? Within mindreading approaches, social understanding requires, among other things, being able to get access to another’s intentions, or more in general, contents of the mind. The “problem” of understanding others’ minds is based on the premise that intentions are hidden and private, that is, that others’ intentions (like thoughts, ideas, beliefs) need to be inferred through complex representational operations (Apperly, 2011). Now, how are such intentions shared? On standard representationalist accounts, this is often proposed to happen through some forms of mental alignment, for instance by simultaneous mirror system activation (Gallese, 2003; Pacherie, 2006; Sebanz et al., 2006). In this view, everyone has her own understanding of others’ intentions to jointly perform an action, but how these understandings become shared remains unclear. For example, Knoblich and Sebanz (2008) have attempted to explain how people can form intentions to act together in terms of three steps. First, they need to be able to derive the other person’s intentions behind her object-directed actions or actions directed to her partner. Then, actors need to be able to keep knowledge of these intentions separate from their own intentions. Eventually, “There needs to be an intentional structure that allows an actor to relate his/her own intention and the other's intention to an intention that drives the joint activity” (2008, p. 2025). Although it may seem very basic, this definition is still quite cognitively demanding, and does not solve the main problem of how an “intentional structure” works. Is it individual or shared, implicitly or explicitly created?

There seems to be a gap here in the form of an empty space in between people: these approaches have explained shared intentionality from an observer’s perspective, but
not from a participant’s one. This is in line with criticisms of the standard approach to social cognition (e.g. Gallagher, 2001; Leudar & Costall 2009) and with views on interpersonal alignment as primarily based on embodied engagement (Macmurray, Bråten, 2003; Reddy & Morris, 2004; De Jaegher & Di Paolo, 2007; Fuchs & De Jaegher, 2009). Shotter nicely summarised these alternative positions: “Motives, intentions, sentiments are (...) directly perceived by those directly involved in [a joint action] as first person actors and second person recipients in that activity. Only third person observers have to make inferences” (Shotter, 1983, p. 39).

Another consideration is whether we need to know that we are cooperating in order to be able to cooperate. Often, cooperation is presupposed as something we set out to do, so that actions are either clearly cooperative or not – a separate and identifiable type of action altogether. This may indeed sometimes be the case, for example when two people meet to perform a certain shared task, like bathing a very agitated dog. But taking this idea as the starting point for understanding cooperation presupposes that we already know what it is, and so there is no need to define the elements out of which it could arise. It precludes, for example, the possibility that cooperation arises without there being a predefined intention or motive to cooperate, while this may be key to understanding how people get to cooperate in the first place. Shared goals may emerge during the course of an interaction, and so participants can ‘roll into’ cooperation without having previous awareness of it. For instance, making space for someone who enters a crowded bus is achieved by the new and old passengers together, each adjusting movements and postures. Here, a common goal emerges out of the interaction and in the context of a small space to be shared as smoothly as possible. Understanding this emergent kind of phenomenon will give us further insights into what cooperation is and how it works.
Where is development? To what extent cooperative actions play a role in human development if cooperation is conceived as heavily relying on high cognitive skills and a long experience with social interactions? As Butterfill has written:

If the leading account were the whole truth about joint action, engaging in joint action would presuppose, and therefore not explain, much of the development of reasoning about others’ mental states. (...) We need a further account of joint action, one that is compatible with the premise that joint action plays a role in explaining how humans develop abilities to think about minds (2012, p. 24).

Furthermore, developmental research on cooperation is based on a rather restricted pool of tasks, which are designed to assess cooperative problem-solving and related abilities like role reversal, perspective-taking and joint attention. These do not necessarily cover the whole range of possible cooperative interactions in a child’s life, as there are many situations (some of which are discussed below) in which a clear, explicit division of roles and statement of goals is not needed. Furthermore, the structure of these tasks implies a “pass or fail” evaluation and seems therefore more appropriate to detect when cooperative skills are already present, rather than telling us how they emerge or develop in time (Thelen & Smith, 1994).

Which view on cooperation one adopts is likely to have rather serious consequences when studying cooperative exchanges in both typical and atypical development. This is, for example, the case with research on cooperation in autism. Studies on cooperation in autism that are based on mind-reading and perspective-taking abilities⁵ find that children with

⁵Mainstream accounts of autism have long proposed that people with autism have difficulties in mind-reading (Baron-Cohen, 1989; Dinishak & Akhtar, 2013), joint attention
autism are less successful than children with developmental delay (Sally & Hill, 2006; Liebal et al. 2007). However, this does not mean that they are completely incapable. For instance they seem to be able to help an adult as needed (Liebal et al., 2007), particularly when they understand the other person’s goals toward an object (Aldridge et al. 2000; Carpenter et al. 2001). Liebal and colleagues explained these findings in terms of a specific impaired understanding of the partner’s role within the cooperative task that would not apply when the situation does not require knowledge of and agreement on each partner’s role. Thus, it may be that children with autism can succeed in cooperative tasks, if they do not entail an explicit understanding and prior agreement on each partner’s role. Similarly, if they are given appropriate interactive support, e.g. if they are helped with being aware of the other person in the interaction, they can cooperate in a dual-control technology task (Holt & Yuill, 2014).

In conclusion, to study cooperation as it develops and in conditions implying impairments in social skills we need to investigate it at a more basic level than has been done so far. The next section discusses what is at stake for individuals participating in cooperative interactions as emerging processes. For doing this, the concepts and research tools of enactment are used, a specific approach to cognition within the embodiment movement in cognitive science (Varela et al., 1991; Thompson, 2007; Di Paolo et al., 2010).

(Loveland and Landry, 1986), or impairments in turn-taking skills (McEvoy et al., 1993), although these findings are not uncontroversial, and even primary proponents recognise that there is always a number of participants who do pass the tests (Happé 1995; but see also Boucher 1989, 1996, 2012; Gernsbacher 2008).
2.2. The enactive perspective on sense-making and social interactions

Enaction is a non-reductive naturalistic approach that proposes a deep continuity between living and cognitive processes. It is a scientific program that explores several phases along this life-mind continuum, based on six mutually supporting, operational concepts: autonomy, sense-making, embodiment, emergence, experience, and participatory sense-making (Varela, et al. 1991; Thompson, 2005, 2007; De Jaegher & Di Paolo, 2007; Di Paolo et al., 2010). Here, two of its main concepts are introduced first: sense-making — the enactive notion of cognition in general; and participatory sense-making — enactive social cognition. In section 3, these ideas are applied to reframe the concept of cooperation.

Sense-making

For enaction, “the mind is seen not as inhering in the individual, but as emerging, existing dynamically in the relationship between organisms and their surroundings (including other agents)” (McGann et al., 2013). Or, as Merleau-Ponty already put it:

The world is inseparable from the subject, but from a subject which is nothing but a project of the world, and the subject is inseparable from the world, but from a world which the subject itself projects (Merleau-Ponty, 1962, p. 430).

In this view, the paradigmatic cases of cognisers are living organisms (Varela, 1997; Thompson, 2007). One of their crucial properties is their constitutive and interactive autonomy, which is defined as a network of dynamical processes (metabolic, immune, neural, sensorimotor, etc.) that actively generates and sustains an identity under precarious conditions (Di Paolo, 2005). An autonomous system constantly produces itself physically, and regulates its interactions with the world to satisfy the needs created by its precarious condition (Di Paolo, 2005). The living organism spontaneously generates its own goals and
responds to the environment (McGann, 2007), in accordance with its self-organisation. The cogniser is therefore always situated in a world that is significant for it, based on this perspective based on need. Its world is not pre-given but largely enacted, i.e. shaped as part of its autonomous activity. For the enactive approach, cognition is embodied, meaning that a cogniser’s activity depends non-trivially on the body. The body is more than just anatomical or physiological structures and sensorimotor strategies; it is the precarious combination of various interrelated self-sustaining identities (organic, cognitive, social), each interacting with the world in terms of the consequences for its own viability (Di Paolo, 2005).

These ideas together ground the enactive characterization of cognition as sense-making: an individual’s adaptive regulation of its states and interactions with the world, with respect to the implications for the continuation of its own autonomous identity. The concept of sense-making describes the relation between an autonomous agent and the world of significance it enacts. It therefore does not conceive of cognitive processes as representational and avoids the known problems of cognitivism. Organisms do not passively receive information from their environments, which they then translate into internal representations whose significant value is to be added later. Natural cognitive systems participate in sense-making as a relational and affect-laden process grounded in biological organisation (Jonas, 1966; Varela, 1991, 1997; Weber & Varela, 2002; Di Paolo, 2005; Thompson, 2007). Sense-making, thus, is valued or concerned acting and interacting, leaving no gap between affect and cognition — they are one in the relation of significance between the individual and world.
Participatory sense-making

Having briefly explained what enactive cognition is, and sense-makers’ inherently meaningful perspective on and interactions with the world, let us now take a closer look at social encounters, the second main element in the enactive sketch of cooperation. The enactive approach considers sociality in its broadest form, namely as intersubjectivity, or the meaningful engagement between subjects (Reddy, 2008), in which three aspects are crucial: engagement, meaning, and subject. Meaning and subjectivity have been explained above in terms of sense-making, namely as the way living (cognising) systems always meaningfully engage with their environment, because they are self-organising and self-maintaining. In this section, the focus is turned on engagement between such concerned subjects.

Crucial to the enactive approach is the focus on social interaction processes, which are complex phenomena involving different dimensions of verbal and nonverbal behaviour, varying contexts, numbers of participants and technological mediation. They impose strict timing demands, involve reciprocal activity, exhibit a mixture of discrete and continuous events at different timescales, and are often robust against external disruptions. Essential to interaction is that it involves engagement between agents. Engagement (Reddy & Morris, 2004; Reddy, 2008) captures the qualitative aspect of social interactions once they start to ‘take over’ and acquire a momentum of their own. It also reflects the way this experience is described in everyday language (e.g. “being in sync with someone”). Experientially, engagement is the fluctuating feelings of connectedness with one another, including that of being in the flow of an interaction.
In order to capture this taking-over aspect of engagement, enactment defines social interaction in terms of the autonomy (as defined above) of the interaction process and that of the individuals involved, as

a co-regulated coupling between at least two autonomous agents, where: (i) the co-regulation and the coupling mutually affect each other, constituting an autonomous self-sustaining organisation in the domain of relational dynamics and (ii) the autonomy of the agents involved is not destroyed (although its scope can be augmented or reduced) (De Jaegher et al., 2010, p. 442-443).

Apart from each agent involved in such a coupling contributing to its co-regulation, the interaction process itself also self-organises and self-maintains. To illustrate this, think of how sometimes, when you encounter someone coming from the other direction in a narrow corridor, you end up in front of each other, then each step aside, moving to the same side at the same time, preventing both of you from continuing on your way. This simple example shows how the interaction process can become autonomous or ‘take on a life of its own’. At the same time, the interactors also maintain their autonomy as participants. This is a necessary condition for calling an interaction social, because if one of the participants loses their autonomy, for the other it would be like interacting with an object or a tool, and thus not a social interaction anymore (De Jaegher & Di Paolo, 2007).

Social interactions are sustained by processes of embodied coordination, including its breakdowns and repairs (De Jaegher & Di Paolo, 2007; Di Paolo & De Jaegher, 2012). Coordination does not necessarily require cognitively complicated skill. Analyses of social interactions and conversations in social science show that participants can unconsciously coordinate their movements and utterances, and this is already the case in mother-infant
interactions (Condon & Sander, 1974; Stern, 1977/2002; Condon, 1979; Scollon, 1981; Davis, 1982; Tronick & Cohn, 1989; Kendon 1990; Grammer et al., 1998; Malloch, 1999; Jaffe et al., 2001; Issartel et al., 2007; Malloch & Trevarthen, 2009). With the concept of coordination and other dynamical systems tools, interaction dynamics can be measured (see e.g. Kelso, 2009). Moreover, they can be related to neural activity (see e.g. Lindenberger et al., 2009; Dumas et al., 2010, 2012; Cui et al., 2012; Di Paolo & De Jaegher, 2012; Konvalinka & Roepstorff, 2012; Schilbach et al., in press).

Based on this definition of social interaction, and the notions of sense-making and coordination, social understanding can now be characterised as participatory sense-making: If, as indicated above, we make sense of the world by moving around in and with it, and we coordinate our movements with others when interacting with them, this means that we can coordinate our sense-making activities. That is, we literally participate in each other’s sense-making activities. Thus, on the enactive account, social understanding is understood as the generation and transformation of meaning together in interaction (De Jaegher & Di Paolo, 2007; De Jaegher, 2009; Fuchs & De Jaegher, 2009). Participants co-create the interactive situation, but also the interaction process as such influences the sense-making that takes place. If a social interaction is as characterised, then people can act together, also for no apparent end or purpose of their own, or even against their individual ends (e.g. the corridor encounter). Even without a shared intention to start with or when entered into against their will by the participants, interacting can change or affect one’s ends or purposes.

This has an interesting consequence for understanding intentions, namely they are truly generated and transformed interactionally, and interacting with each other opens up new domains of sense-making that individuals would not have on our own. This contrasts
with the way intentions are conceived in cognitivist approaches to cooperation, as introduced above, namely as hidden, and only shareable by high-level cognitive mechanisms. On the account presented in this study, intentions do not first arise or are first made individually, but they emerge as the interaction goes on (Di Paolo, under review). Therefore, intentions are visible and understandable by each participant, also in cooperative interactions, as they are contextualized and stem from that specific ongoing interaction. This makes understanding and aligning with the other’s intentions un-mysterious: it happens in doing things together, which is moving together, since movements are already and always imbued with meaning for sense-makers (Johnson, 2007; Sheets-Johnstone, 2011; Merritt, 2013). On the basis of this, it is possible to see how intentions can evolve in their jointness, meanings and specificity for those involved throughout interaction, including cooperative ones.

**Cooperation as a process**

Starting from the most rudimentary or minimal form of cooperation may be possible to make it understandable from a developmental point of view. With the enactive concepts of sense-making and participatory sense-making in hand, let us now look again at cooperation, starting from its basic definition as “i) acting or working together and ii) a common or the same end or purpose” (Tuomela, 2000, p. 3).

Considering social interactions as already cooperative in a basic sense, it is possible to integrate it with a developmentally-grounded definition by Hubley and Trevarthen, proposing that
cooperation means that each of the subjects is taking account of the other’s interests and objectives in some relation to the extrapersonal context, and is acting to complement the other's response” (1979, p. 58).

In line with what has been proposed so far, “taking account of the other’s interests and objectives” does not need inferences, but may happen through embodied interactions that are meaningful in the given situation and in the interactional history. These actions are complementary in that they fit each other in some form. This is not only the case for positive cooperation but also for situations in which individuals argue and disagree about something, where some complementarity is still needed in order for the disagreement even to be played out. This means that there are different forms, layers, and aspects of cooperation: embodied, in time, in space, in topic, imitative or complementary, etc. Interacting guarantees that some basic cooperative layer is present (e.g. in the corridor situation, individuals cooperate to stop cooperating). Also, since sense-making always involves affect, this view of cooperation becomes less intellectualistic and begins to investigate how affective processes may be involved in cooperation. Then, the challenge is to investigate what further levels of cooperation are present in a specific interaction or situation, over and above the basic interaction process. This can involve different, increasingly more complex levels of sense-making.

Like the enactive approach, interactionist approaches such as ethnomethodology and conversation analysis have also based their empirical programme on a theory of social interaction as a dynamical constructions and a view of others’ intentions as mutually accessible and accountable for. Ethnomethodology was originally developed by Garfinkel to “discover the methods that persons use in their everyday life (...) in constructing social
reality” (Psathas, 1968, p.509), and thus entails the study of how this reality is constructed, produced and organized in social encounters. Derived from phenomenology, it shares with it an interest in exploring the participants’ embodied experience of being engaged in mundane interactions; the latter are seen as phenomena in their own right, yet situated in specific cultural contexts and practices (see, for instance, the work of Schütz, 1967/1932). Inspired by ethnomethodology and by Goffman’s work on the interaction order (1983), Conversation Analysis (Sacks, Schegloff, & Jeffersons, 1974; Sacks, 1992; Schegloff, 2007) investigates the systematic features of naturally occurring conversations. In a large body of work now spanning over five decades, it has revealed the fine, moment-by-moment coordination of speakers, and the sequential structuring that enable the orderly participation of different interactors across turns-at-talk and within complex activities. Central in this approach is a view of human communication as multimodal, where different but integrated communicative resources (verbal and non-verbal) contribute to establishing the interactional context, anticipating, co-constructing, and if necessary repairing the emergent definition of what is going on (Kendon, 1990; Streeck, et al., 2011; Tulbert & Goodwin, 2011). Thus, interactions are always cooperative, inasmuch as participants orient to, monitor and support the interlocutors’ understanding and act so as to enable their successive moves (Goodwin, 1995; 2013).

Intentions and goals are not searched before or behind the communicative action as its ‘cause’, but are manifest in speakers’ behaviour, shaped and adjusted as the interaction unfolds. Within this framework, and in convergence with enactivism, cooperating is possible even for those - like young children - who do not possess a robust capacity to ‘read’ others’ intentions or plans, but can nevertheless participate in joint, situated interactions (Forrester, 2008; Mehus, 2011; Lerner et al., 2011).
Cooperation in infancy

What are the implications of this theoretical shift for understanding cooperation in infancy? Since infants cannot remain alive alone, they need others to help them with nourishing, shelter, hygiene, and social interaction. In line with what has been suggested so far, infants contribute actively to this caring, because they are themselves sense-makers, generating and maintaining their own living identity, and also, quite possibly, already their social identity (Stern, 1985; Delafield-Butt & Gangopadhyay, 2013).

Hubley (1983) defined cooperation in infancy as the joint management of objects, actions or ideas to fulfil a purpose that two interactors share. She identified some minimum requirements for cooperative actions in infancy, which are 1) a shared plan of action within mutual orientation, with the infant attending to and acting with reference to the partner’s indicated purposes; 2) active contributions to a single coordinated event, which, on the infant’s part, is seen as a clearly identifiable and oriented action to influence the behaviour of the partner and then mesh with the partner’s action to complete a shared purpose; 3) willing participation. On the one hand, such a definition seems fitting with the infant’s limited communicative resources as it does not imply that the partners should verbally agree on a shared plan or goal. However, it presupposes that some shared plan has been somehow established, and requires that each partner understands the interest or purposes of the other regarding the shared action. As already argued, such an explicit agreement may not be required in all forms of cooperative interactions.

Mary Catherine Bateson (1979) explored the dynamics of early dialogues, so called ‘proto-conversations’, between mothers and infants, as contexts for learning how to participate and sustain joint performances, describing the
‘Exquisite ritual courtesy’ and precise cooperation of a two-month-old infant with the mother by expressive face and body movements, and by delicately modulated vocal sounds, and (she) concluded that the behaviours of both baby and adult revealed innate foundations of language (Trevarthen, 2013, p. 7).

On the same line of Bateson’s research, the fundamental contribution of past developmental research has been to reveal how early communicative interactions are created out of contributions of both the infant and the caregiver (Hubley & Trevarthen, 1979; Trevarthen, 1979). Bruner (1977) recognised shared reference and role-taking as cooperative features in communicative interactions involving giving and receiving objects before one year of age. More recent observations have demonstrated how, since very early in life, infants adjust and facilitate actions directed to them, especially in daily routines such as when the caregivers pick them up, change their nappy, or play a social game with them (Service, 1984; Nomikou & Rohlfing, 2012; Reddy et al., 2012; Rączaszek-Leonardi, et al., 2013; Fantasia et al., 2014). In a perspective that considers social interactions as basic forms of cooperation by participating in shared, meaningful interactions, infants practice their ability to make sense of and coordinate with the caregiver’s action, becoming increasingly skilled in their social participation.

The importance of interpersonal coordination for participating and making sense with the other in interaction was already stressed by research on neonatal imitation. Researchers discovered that early forms of imitation were grounded in the precise coordination of timing and movements, playing an essential role in the building up of early communicative modalities (Nagy, 2011; Trevarthen, 2015), such as turn-taking.
One of the criticisms addressed to existing studies was that they measured children's cooperative ability when they successfully performed a joint pre-fixed task, regarding cooperation as a cognitive skill that can be switched on and off means neglecting the importance of learning processes that sprout from and within cooperative interactions. In contrast, in a here-and-now perspective the process of cooperating enables children to build up their actions moment by moment through a sequence of relational adjustments and (dis-)engagements towards a joint goal. Thanks to its structuring and structured nature, cooperation may be seen as a framework in which development occurs and at the same time as a mode of being with others learnt during development. If what was proposed so far is taken seriously – that any interaction requires some basic cooperation, followed, in some cases, by a process of co-negotiation towards a more or less explicit goal that matters to those who are involved in that process – then it also could be possible to explain how this process develops. Namely, exploring how participating in goal-directed joint actions supports and shapes infants’ development.

**Cooperation in autism**

A different theoretical perspective may also open up new possibilities for investigating cooperation in autism. As reported above, empirical findings suggest that some children with autism (at different chronological ages) perform poorly in high-level cooperative tasks and in other correlated abilities, such as joint attention, imitation, perspective taking, and role-reversal (see, for instance, Colombi et al., 2009). Yet, performing “poorly” does not mean that the capacity is absent, and indeed some children with Autistic Spectrum Condition (ASC) do pass the cooperative tasks. This result is not consistent with the
theoretical premises informing the design of the tests and the difficulties of children with autism, classically understood. One way to explain this (controversial) evidence may lie in changing the premises, instead of post hoc adjustments to the interpretation.

Studies of the verbal production of children with autism that do not start from a deficit but try to understand the children's spontaneous interactional behaviour, can help to illustrate and support this shift of perspective. Conversation analysis studies, for example, allow us to observe how even echolalic productions (the repetition of utterances with no apparent relation to prior talk from other speakers), often seen in children with autism, are in fact responsive moves (Loca & Wootton, 1995; Wootton, 1999; Stribling et al. 2005/2006; Sterponi & Shankey, 2014). The repetition of available utterances helps children to stay in the conversation despite their difficulty with improvising a newly designed turn. Sometimes these stereotypical contributions can take the form of questions and feed the progression of an interaction, supporting the child’s continued participation in a social exchange (Sterponi & Fasulo, 2007).

Dickerson et al. (2007) have also shown that observing what children actually do reveals capacities for cooperation that cannot emerge in pre-defined tasks, for sometimes the ways in which children find solutions for their difficulties are not incorporated into the tasks. They investigated classroom interactions between two autistic children and their tutors. The children were asked to answer questions, using answer-cards. During the session, each of the children tapped the answer-cards, an action which at first sight seemed meaningless. However, using conversation analysis, Dickerson and colleagues could show that the children tapped on the cards just before they started answering, and sometimes continuing into their answering. This seems to indicate that the tapping is a way of engaging and of “projecting a relevant forthcoming response on the part of the child”
(Dickerson et al., 2007, p. 297). In other words, the children found means to signal their ongoing engagement when the timing of their verbal production was delayed, thus cooperating to the maintenance of the interactive plane.

Using fine-grained observational methods, the actions of all participants can be studied and analysed in interaction, making it possible to pick up the forms of cooperation that infants and people with autism are capable of (see also Stribling et al., 2009). These examples demonstrate how the use of non-verbal and non-vocal resources for building up a co-participatory model of how the child and teachers work together becomes possible thanks to transcripts of the interactions. In this way, not only the participants’ talk, but also a number of non-verbal activities that are salient for the interaction are acknowledged. These results fit well with the Vygotskian idea that collaborative work leads to learning (Vygotsky, 1978; see also Goodwin, 2013). Furthermore, these studies suggest that ways to observe cooperative interactions in autism exist, if only autism and interaction are considered from a different perspective. During everyday interactions at home or school, in the car or at the park, children with autism are involved in many simpler, not-always-explicit cooperative exchanges. Not only are the children part of these exchanges, but they also grow into them; namely, they learn to be active partners out of everyday cooperative interaction, just like every other child does. This is not to say that there are no difficulties or differences, but social understanding in autism may be more fruitfully studied from the basic and positive perspective put forward here.
2.3. Discussion

In summary, the perspective shift we propose has implications for understanding typical development as well as autism. Firstly, it supports a developmental stance on cooperation in that it explores how we become cooperative interaction partners in the first place. If high-order mental skills (or a great deal of ‘social experience’) are assumed to be prerequisite for cooperating, it would not be possible to see how infants can grow into social interactions and gradually learn to engage with the social world around them, but rather wait until much of the development has already happened. However, proposing that cooperation is an aspect of interacting and understanding each other, it does become possible to investigate how it emerges and is learnt in early interactions. In this perspective, cooperation in infancy is a product of development, as well as a process in which development occurs.

An interesting aspect to consider regarding development is how to conceive of cooperation in asymmetrical interactions. Infants seem to be able to cooperatively coordinate with caregivers from very early on (see e.g. Reddy et al., 2013; Fantasia et al. 2014), but they may not do it with peers until later on, as suggested by some research (Warneken & Tomasello, 2006, 2007). From an enactive point of view, it is not surprising that infants are better able to cooperate with a caregiver than with a peer, since the presence of someone with more interactive experience makes the overall interaction more effective. This is related to Vygotsky’s notion of the zone of proximal development, where it is possible to scaffold someone in interaction to be jointly more capable of activities they cannot yet do alone (1978). What is needed for an interaction to be cooperative if the relation is asymmetric? If we think of a pick-up situation, we know that the adult is doing
the major part by actually holding the infant and lifting her up. Yet, infants are not passively waiting for it to happen. They make specific preparatory body adjustments that facilitate the mother’s movements, and thus, the pick-up sequence (Service, 1984; Reddy et al, 2012). At the same time, when the adult fails to complete the expected pick-up sequence, infants seem to stop being cooperative by dropping their body tension and participation (Fantasia et al, forthcoming). In this case, although the mother has the main role in making the pick-up sequence effective, the infant’s role is essential in its being clearly oriented towards the joint achievement of the interaction. Obviously, asymmetry may or may not play a strong role depending on the task.

As a second point, if we are to understand autism in general, and specifically people with autism’s capacity to cooperate (which is firstly a particular form of social interaction) the change of perspective proposed here may also be helpful. How? forsaking a typical-development perspective and, as Petra Björne and other authors have already suggested, paying more attention to what people with ASC can do and the way they describe their own experiences (Björne, 2007; Robledo et al., 2012; De Jaegher, 2013; Donnellan et al., 2013). As shown by the studies on autism presented in the previous section, considering actions in their interactional context and in their significance for all participants, it becomes possible to understand the emergence of cooperation also in the interactions of and with people with autism. Exploring cooperation in children with autism from an observer or third-person perspective not only fails to take into account the child’s experience of cooperating as an engaged partner; it also cuts out how the other person is feeling or experiencing the child as a partner. In cases like autism, in which social interactions run a different course, in which jointly attending to an object may not be at the core of the interaction, approaching cooperation from a second person perspective can make all the difference.
This work thus suggests that future studies on cooperation and autism should include more ecological observations and parental reports. This involves: finely studying the interaction (e.g. through ethnomethodology or conversation analysis), taking into account the context or the environment (using, for instance, parental reports or ecological observations), and studying what is at stake for the individuals involved (i.e. asking how they make sense in and of the interaction).

**2.4. Conclusions**

The present work aimed to show that it is possible to encompass a wider range of cooperative interactions, not only those in which interactors explicitly agree upon and set rules and roles for a specific shared task to be performed. This is not to neglect that in some particular scenarios participants do need to make efforts to make sense of the other’s intentions, and indeed goals need to be set out and agreed beforehand. Only, this is not always the case, as cooperation is a multi-layered process that may take different forms. In this perspective, the authors share Tollefsen’s view that intentions-in-action can emerge out of ongoing interaction (Tollefsen & Dale, 2012), with the minimum requirement that interactors share an interactional space. Cooperation is a form of participating in each other’s sense-making, in which individuals may form a goal or purpose together while interacting. It is not a skill that can be lacked but rather a way of being with others that is possible to learn. Learning to cooperate then becomes understandable as an important aspect of typical and atypical development. For this reason, future developmental research on cooperation (and social cognition in general) could benefit from more ecological observational methods and less adult-centric approaches (Donaldson, 1978). As the adult’s
way of cooperating is an already fully-blossomed one, one in which the picture is complete (and intentions can be easily inferred if needed), we need instead to observe infants and their daily living and discover the basic, emerging ways in which cooperation develops.
References


3. CHANGING THE GAME: EXPLORING INFANTS’ PARTICIPATION IN EARLY PLAY ROUTINES

Abstract

Play has proved to have a central role in children’s development, most notably in rule learning (Piaget, 1965; Sutton-Smith, 1979) and negotiation of roles and goals (Garvey, 1974; Bruner et al., 1976). Yet very little research has been done on early play. The present study focuses on early social games, i.e. vocal-kinetic play routines that mothers use to interact with infants from very early on. We explored 3-month-old infants and their mothers performing a routine game first in the usual way, then in two violated conditions: without gestures and without sound. The aim of the study was to investigate infants’ participation and expectations in the game and whether this participation is affected by changes in the multimodal format of the game. Infants’ facial expressions, gaze and body movements were coded to measure levels of engagement and affective state across the three conditions. Results showed a significant decrease in Limbs Movements and expressions of Positive Affect, and an increase in Gaze Away and in Stunned Expression when the game structure was violated. These results indicate that the violated game conditions were experienced as less engaging, either because of an unexpected break in the established joint routine, or simply because they were weaker versions of the same game. Overall, our results suggest that structured, multimodal play routines may constitute interactional contexts that only work as integrated units of auditory and motor resources, representing early communicative
contexts which prepare the ground for later, more complex multimodal interactions, such as verbal exchanges.

3.1. Introduction

The present study explores infants’ participation in play routines with their mother, through observing their response to un-expected alterations of a familiar social game. Play has been widely explored for its central role in children’s development, most notably in rule learning and negotiation of tasks, roles and goals (Piaget, 1951, 1965; Bruner et al., 1976; Vygotsky, 1978; Sutton-Smith, 1979; Camaioni & Laicardi, 1985). Through play, children learn how to deal with others’ expectations and feelings and, even more, they learn about their own feelings, desires and goals when confronted with those of the others (Blurton-Jones, 1967; Coleman, 1967). Playing together is not merely the sum of single responses to the partner’s play, but rather a creative process emerging from the interactional dynamics between different individuals in a specific cultural context (Fogel 1993). To be engaged in a social game is thus - at the same time - a developmental goal and an instrument through which development occurs, and an ideal place to investigate social interactions.

Although it is generally agreed in developmental research that children’s social play has intrinsic co-operative qualities, the same has not been demonstrated for infants' play. Indeed, relatively little research has been done on the formats and structures of early mother-infant multimodal games, and how infants participate in them.

Previous studies have explored the mother-infant’s mutual building up of “free” play interactions around 3 months of age (Stern, 1974; Trevarthen, 1988) and spontaneous peekaboo play episodes in the context of language acquisition from around 5 months.
(Bruner & Sherwood, 1976; Ratner & Bruner, 1977). Mother-infant free play has been also described in terms of negotiation of interactional boundaries and points of transition (Stern, 1974), the different ways of alternating participation (turn-taking) and the manners in which a play sequence may be built up through a considerable spatio-temporal structuring (Garvey, 1974). Besides these pioneering studies, very little research has been done on structured game routines in infancy, like early nursery rhymes or vocal-kinetic combinations of gestures and songs (Mehus, 2011). Since these routines are well known to be played by mothers from very early on, they are also part of the infant’s daily experience of participating in structured, meaningful interactions, such as being fed or dressed, or play a familiar game. These routines have proved to help infants to coordinate with the adult’s actions (Hubley, 1983; Trevarthen, 1977) and to become skilled cooperative agents as they participate in them (Lerner et al., 2011; Raczaszek-Leonardi et al., 2013). Routines, as they are familiar and predictable, also orient the infant’s capacity to anticipate the other’s action and create expectations on the other’s behaviour (Ambrosini et al., 2013; Reddy, et al., 2013).

Infants’ expectations have been an area of considerable investigation in developmental research (Spelke, 1985; Baillargeon, 1994). One way to explore them is by introducing changes in a familiar situation, that is, by violating them. Studies using this method have typically focused on the infant’s reaction to maternal breach in engagement, or withdrawal from the ongoing interaction. Research showed that at around 3 months of age infants react by frowning and gazing away from an adult who abruptly stopped interacting with them (Lamb et al., 1987; Tronick & Cohn, 1989). At around 4 to 5 months infants protest (crying more loudly) and orient away when an adult intentionally fails to soothe them by picking up, letting the infants’ expectations unmet (Lamb & Malkin, 1986);
around 9 months infants can detect game interruptions by their playing partner, increasing their vocalisations to call her back in the game (Ross & Lollis, 1987), and at 10 months they increase their gaze to an adult’s face whose action was blocking the infant’s play with a toy (Phillips et al., 1992). These studies support the idea that infants are sensitive to alterations of the adult’s usual behaviour from very early on⁶.

This study differs from previous research as it looks at infants’ reaction to violations of the multimodal format of a familiar play routine, by a partner that is still affectively engaged with them. Notwithstanding, it shares the same conceptual grounding of previous research: observing the infants’ participation in a familiar situation and the way it changes in response to unexpected behaviours, in order to learn more about how infants take part in, and make sense of early social interactions. The aim of the present study is thus to explore the structure of early social games commonly played by mothers, and how infants participate in them. In addition to this, we want to investigate whether infants show signs of expectations on the game structure by looking at how their participation changes if the familiar game is played differently. To do this, twenty 3-month-old infants and mothers were observed playing a structured, multimodal game in the lab as they usually do at home, and subsequently a unimodal, violated version of the same game: without gestures and without sounds. Limbs Movements, Gaze Away and facial expressions were coded and compared across conditions, to measure changes in the infants’ behaviour as response to violations of the game as expected.

⁶See Murray and Trevarthen (1986) and Nadel, Carchon, Kervella, Marcelli, and Réserbat-Plantey (1999) for contingency expectancies studies; see also Tronick, Als, Adamson, Wise, and Brazelton (1978) for still face paradigm studies.
3.2. Method

Participants

Twenty mothers and their 3-month-old infants (10 girls, 10 boys, $M=96$ days; $SD=4.04$ days) participated in the study. All the mothers have been living in the UK since at least ten years, and two mothers out of 20 were not native British citizens. All infants were Caucasian and on average healthy birth weight ($M=3.36$ Kg, $SD=0.40$ Kg). Seven infants were firstborns, four were born with slight complications, three mothers underwent a caesarean and one mother had a particularly long labour. The mothers’ ages at the time of birth ranged from 26 to 37 years ($M=31$ years, $SD=3.44$). Five dyads were excluded from the original sample of 25 infants due to the infants’ fussiness and lack of interest at the beginning or in the middle of the procedure. Volunteer parents were recruited through different children and family centres, nurseries and pre/antenatal classes in town, which resulted in an heterogeneous socioeconomic background.

The *Bayley Scales of Infant Development* – Second Edition (BSID-II) (Bayley, 2006) were used to check the infants’ motor maturity, cognitive skills and developmental age equivalent. Results from the Bayley Mental and Motor Scales assessment showed that only one out of twenty infants scored lower than one percentile under the average in the Mental Scale (Mental Index score= 82) but not in the Motor Scale (Motor Index score= 88). This baby’s behavioural responses were checked and resulted as not performing distinctively different from the average responses of the other infants. Thus, this one baby was not removed from the sample. Results are shown in Table 3.1.
Table 3.1. Bayley Scores and Age Equivalents

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean Index Score</th>
<th>SD</th>
<th>Mean Developmental Age Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental Scale</td>
<td>88.5¹</td>
<td>12.1</td>
<td>2.8 Months</td>
</tr>
<tr>
<td>Motor Scale</td>
<td>92.8²</td>
<td>7.8</td>
<td>3 Months</td>
</tr>
</tbody>
</table>

Note. ¹Mental Score Range: 82-104; ²Motor Score Range: 88-105

Procedure

Mother-infant dyads were observed in a quiet, spacious room, and to avoid any additional stress observations were arranged at a convenient time for mothers. All of the procedures in the study underwent ethical approval by the Science Faculty Ethics Committee, which abides by the BPS Guidelines for Research with Human Participants, and all the mothers were asked to sign a written informed consent.

The observation room contained a soft mat placed on the floor with some toys, a table with two chairs and four sofas. The experimenter was helped by an assistant who, at the beginning of the observation, asked the mother general information about the infant and the kind of games they usually play together. Before administering the BSID the experimenter and the infant played on the mat to get familiar for approximately 3 to 5 minutes. The length of BSID assessment was on average 12 minutes. Then the play observation began, consisting of three phases: an initial warming up period of approximately 5 to 7 minutes, a “normal” performance of a familiar game (normal condition) and then two variations of that same game (no-sound and no-gestures conditions).
Since our specific interest was to explore whether changes in the multimodal elements composing the game format affect infants’ participation in the game, we focused on violations which do not expose the infant to a maternal withdrawal of engagement. In the normal condition phase, our baseline episode, mothers were asked to play one or two routine social games of the kind of nursery rhymes, in the same way she would normally do at home. As described above, these kind of social games have a vocal-kinetic format, as they are compound by a (usually) rhymed song accompanied by hand gestures. To investigate the infants’ participation and expectations on the game structure, mothers were asked to perform the same game in two variants: once without using any sound (no-sound condition) and once without doing any gestures (no-gestures condition). Namely, mothers made no movements in the no-gesture condition, and made no sounds in the no-sound condition. The performance of each condition was spaced out by approximately two minutes of free interaction, and the violated conditions sequence was randomized between and within infants to control for order effect.

Mothers were not instructed to avoid any particular affective behaviour (i.e. to display a neutral face, or avoid smiling, or looking at the infant), but encouraged to hold the baby in the same position she had done during the normal condition, also when she had to make no gestures. For instance, if the position of the infant was to be held up by the armpit in the normal version of the game, we asked the mother to keep holding the baby in the same way in all the three conditions. In the no-gestures condition the mother was asked not to move her hands or the baby (shaking, pulling, bouncing up and so on), whatever her position. If the infant gave signs of distraction or discomfort, the procedure was stopped and resumed from the last game condition (when possible); this happened three times out of 20 infants, spread over conditions.
The entire sequence was videotaped by two cameras mounted on tripods. One camera was positioned on a 45° angle from the mother, triadically with the camera and the infant; the other camera was fixed focusing on the mat to be used for the BSID assessment.

**Coding**

The infants’ Limbs Movements, Gaze Away, and Affects (Positive and Negative) were coded from video recordings of the entire procedure. These measures have been widely used in the literature on infants’ social expectations (Toda & Fogel, 1993; Legerstee & Markova, 2007). For instance, attention patterns like gaze orientation are revealing of infants’ emotions: Infants have been shown to look intently at interesting stimuli, but to avert gaze from a person who stare at them impassively (Tronick et al., 1978; Toda & Fogel, 1993). Body movements have been found to be powerful indicators of infants’ discrimination of the other’s intentional versus unintentional actions (Behne et al., 2005), and infants’ anticipatory adjustments (Service, 1984; Reddy et al., 2013). As Adolph and Berger wrote (2006), “Movement is perhaps the most ubiquitous, pervasive, and fundamental of all psychological activity. It is the hallmark of animacy and the essence of agency” (p. 181). The relative frequency of presence/absence of each behaviour was coded second-by-second, and only once for each second by a coder blind to the experimental hypotheses and conditions. For the coding we used ELAN, a video-analysis software that allows for the creation of complex annotations on video and audio resources (Wittenburg et al., 2006). A second blind observer independently coded 50% of the infants (10 infants in all three conditions). Inter-observer agreement was determined by using Cohen’s Kappa coefficient. Reliability was high for all behaviours (Positive Affects $\kappa = .82$, Negative Affects, $\kappa = .75$, Gaze Away, $\kappa = .78$, Limbs Movements, $\kappa = .85$; all $p< .001$).
*Limbs Movements* are the combined coding of arms and legs. A code of leg or arm movement was assigned when there was a substantial change of position in space observed in arms or legs. Shivers, trembling or jerky moves were not considered as movements.

*Gaze Away*. The infants’ gaze was coded as “Away” every time the infant looked sideways, up to the ceiling or when the infant’s head was turned off from the mother’s face.

*Positive and Negative Affects*. Infants’ facial expressions were coded as “Positive” and “Negative” Affects (Camras & Shutter, 2010). Positive Affect was encoded as smiles (raised cheeks and corner of lips turned up with mouth open or closed) and laughs (raised cheeks, mouth open, lower and upper gum visible, eyes open or winked, possibly accompanied by some vocalisations). A code of Negative Affect was assigned to frowns (furrowed brow and downturned mouth) and sad expressions (mouth, eye brows and cheeks turned down) (Legerstee & Markova, 2007).

*Stunned Expression*. A coding of Stunned Expression was assigned when the infant showed wide open eyes, open mouth or mouth close but still, neutral lips (Meltzoff & Moore, 1977). Previous studies on violations of expectations have used ‘puzzlement’ as dependant variable as index of the infant’s reaction to ambiguous and unexpected stimuli (Tronick, 1989; Camras et al., 2002). With respect to stunned expressions though, puzzlement seems a less neutral measure. So, we decided to code components of puzzlement such as eyebrow frowning and downturned lips as Negative Affect; instead, with Stunned Expression we wanted to capture as widely as possible any infants’ reaction of surprise and uncertainty.

*Games durations and selection*

We asked the mothers to play a routine game which included singing a song and gesturing, that was also familiar for the infant. When dyads had more than one type of
game recorded, we used the game that was more familiar for the infant according to what mothers told us in the preliminary interview. When played normally, games lasted approximately 28s ($M= 28.04s$, $SD= .24$); when violations were introduced, games mostly maintained their original lengths (no-gestures: $M= 27.9s$, $SD= 1.4s$; no-sound: $M= 27.5s$, $SD=1.2s$). A Friedman’s analysis of variance (ANOVA) was performed to control that game durations within babies had not significantly changed when the mothers introduced the two violations. Tests were conducted using Bonferroni adjusted alpha levels of .02 (.05/3). Results confirmed that games lengths across conditions did not significantly differ ($\chi^2 (2)= 2.784, p=.249$), and therefore games lengths have not been standardised.

**Data Analyses**

Because of the nature and quality of data (frequencies), the small sample size and repeated observations, non-parametric repeated measures analyses were performed. Tests were conducted using Bonferroni correction of .01 per test (.05/5), and were exact and two tailed. Friedman's ANOVA has been used to compare infants' Limbs Movements, Gaze Away and affective expressions across conditions (normal, no-gestures and no-sound). ANOVA results were followed-up by pairwise comparisons between conditions using Wilcoxon Signed Ranks test. A nonparametric measure of the effect size, $r$, was used (Ivarsson et al., 2013) and results are showed in the following section. No significant effect of the order in which the two violated conditions were presented was found.
3.3. Results

Games description

The dyads we observed played games which present similar formats, with few structural differences. They are built on units of sequenced actions formed by patterns of gestures and vocalisations often repeated throughout the game. Games differed in their basic features, i.e. rhythm, type of gesturing, voice tone, the position of the infant and the mother (see Table 3.2.). Some games had the infant upright seating with arms held forward by the mother, others had the infant laying on the back; few games had the infant made flying up and down held on the waist by the mother. Similar games appeared to have been adapted by mothers and showed some variations, mainly in the infant’s posture. For example “Row Row Row your Boat”, in which the mother performs a rowing motion so that the infant repeatedly leans towards the mother and away, was played in three different variants: with the infant’s upright seated, or laying on the mat or embedded in to the mother’s stretched legs. Overall, the games appeared to be well tuned on to the infants’ attentional abilities, alternating patterns of increasing stimulation (e.g. higher pitch of voice, faster movements) with periods of decreasing activity and pauses. Furthermore, their structure was build up on repetitions and rhymes. In “Head, Shoulder, Knees and Toes”, for instance, the refrain was symmetrically placed at the beginning and the end of the game, as opening and closure, but sung with a different intonation.

Qualitative observations of the videos also revealed similar individual patterns of movements in infants playing the same kind of games in the normal conditions. For instance, infants playing “Row Row Row your Boat” showed similar frequencies of Limbs
Movements: higher within the first 5s of the game ($M= 4, SD= .07$), decreasing in the middle (approximately after 10-12s; $M= 3.25, SD= .66$) and lower in the last 5 seconds of the game ($M= 3.11, SD= .57$). On the contrary, infants playing “Head, Shoulder, Knees and Toes” moved both the arms and legs more in the middle of the game (approximately after 9 to 10s; $M= 4.67, SD= .04$) compared to the first 5 seconds of the game ($M= 3.33, SD= .47$) and the last 5 seconds ($M= 2.33, SD= 0.47$). Examples of two infants’ individual bodily patterns are shown in Figure 3.1. and 3.2. Higher scores represent movements of both the arms and the legs simultaneously, whereas lower scores represent single movements either of the arms or the legs or absence of movements.
Table 3.2. Types and structure of mother-infant early social games

<table>
<thead>
<tr>
<th>Name of the game</th>
<th>Row Row Row your Boat</th>
<th>Head, Shoulder, Knees and Toes</th>
<th>Hickory Dickory Dock</th>
<th>The Grand Old Duke of York</th>
<th>Other games</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of dyads</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Position of the infant</td>
<td>Usually seated</td>
<td>Laying down</td>
<td>Laying down</td>
<td>Laying down or held up</td>
<td>Laying down</td>
</tr>
<tr>
<td>Position of the Mother</td>
<td>Seated facing the infant</td>
<td>Leaning forward upon the infant, rarely seated</td>
<td>Leaning forward upon the infant or seated</td>
<td>Leaning forward or steadily seated</td>
<td>Leaning forward</td>
</tr>
<tr>
<td>Structure</td>
<td>The mother is holding the baby by the arms performing a rowing motion with them, swinging the infant back and forth repeatedly. The song is divided in lines. Each line has a peak of intonation in the middle, and a pause at the end before the next line starts.</td>
<td>The mother touches the infant's bodily part as she is naming them in the song, starting from the head. The first verse of the song is repeated twice at the beginning and closure of the game with a different intonation. The song has a peak of vocal tension and acceleration in the middle, which then slowly decreases until the end of the game.</td>
<td>The mother alternates between touching the infant's body parts and clapping her hands. In the end she holds the baby's legs up, swinging them sideways. The song has a peak of vocal tension and acceleration in the middle, which then slowly decreases until the end of the game. The main line is repeated in the end.</td>
<td>One version has the mother holding the baby's hands moving them up and down. In one other version the mother holds the baby up to make her rocking up and down. Singing is accompanied by gestures, accelerations, pauses and decrease of activity.</td>
<td>In the first game the mother kisses the baby's cheek while gently looming. In the second game she shakes up the baby's legs making a loud sound and then singing.</td>
</tr>
</tbody>
</table>
Figure 3.1. represents individual patterns of one infant (R.). The first peak of arms and legs movements appears after about 5 seconds from the beginning in the normal condition, but only after about 6 seconds in the no-sound. Similarly, another peak of movements is shown after approximately 12 seconds when the game is played normally, only to appear with almost one second later in both the violated conditions. Furthermore, the infant moves from the beginning to the completion of the routine, i.e. form the first to the last second, only when the game is played normally and with gestures, but he starts moving one second later in the no sound condition. Similar results were found in 12 infants out of 20, showing that 6 infants delayed their movements only in the no-sound condition, 4 infants delayed their movements in both the no-sound and no-gestures conditions and 2 infants only in the no-gestures condition.

Figure 3.2. depicts another infant (K.) during “Head, Shoulder, Knees and Toes”. When the game is played normally, K. moves more and for longer periods than in the no-sound or no-gesture conditions. She also holds longer periods of arms and legs stillness when the game has no sound compared to its normal version, with movements eventually fading out as the game comes to the end. Since K appears to be overall very active when the game is played normally, moving frequently and often combining both arms and legs, her periods of stillness in both the no-sound and no-gestures conditions stand out even more evidently than in R.

Figure 3.3. shows baby R. playing Hickory, Dickory Dock, and how his participation changed when the game was altered. During the normal version of the game, R. is openly laughing, and his upper body seems slightly twisted, as to accompany the mother’s movement (Figure 3.3A). He vocalizes vividly, and seems enjoying the play interaction. When the game is played with no gestures, R. gazes away and does not show
signs of enjoyment. His arms and legs are still and relaxed, and he seems attending to something external, behind the camera (Figure 3.3B). When the game is played with no sound, R. appears very concentrated on the mother’s action, but not affectively participating: He does not show any positive affect (Figure 3.3C).
Figure 3.2. Individual Limbs Movements of K. playing Head, Shoulder, Knees and Toes in the three conditions. The order of condition presented was normal, no-sound and no-gesture. A score of 2 indicates movements of both the arms and the legs simultaneously, whereas a score of 1 indicates a single movement of either the arms or the legs. A score of 0 indicates absence of movement.
Figure 3.3. R. playing *Hicory Dickory Dock* normally (A), with no-gestures (B), and no-sound (C).
Effect of games violations on the infants’ behaviour

Mean and standard deviation values of the infants’ behavioural responses are presented in Table 3. Analyses of Friedman’s ANOVA were conducted for each of the dependent measures, revealing significant effect of game violations on Limbs Movements $\chi^2 (2) = 27.410, p < .001$, Gaze Away, $\chi^2 (2) = 13.914, p = .001$, Positive Affect, $\chi^2 (2) = 29.059, p < .001$, and Stunned Expression, $\chi^2 (2) = 8.044, p = .001$. No significant differences were found for Negative Affect, $\chi^2 (2) = 5.344, p = .069$. The Wilcoxon Signed-Rank test showed that Limbs Movements were significantly higher in the normal compared to the no-sound ($z = -3.923, p < .001, r = .877$) and no-gestures ($z = -3.728, p < .001, r = .877$) conditions. According to Cohen (1988), the effect of these differences was large in both cases. No differences were found between the two violated conditions ($z = -1.192, p = .233$). Gaze Away comparisons showed that infants gazed away more often in the no-sound than the normal ($z = -3.626, p < .001, r = .468$), and no-gestures condition ($z = -2.600, p = .009, r = .335$) but not in the no-gestures compared to normal condition ($z = -1.462, p = .144$). Positive Affect was significantly higher in the normal condition than the no-sound ($z = -3.652, p < .001, r = .471$) and no-gestures ($z = -2.883, p = .004, r = .372$), and significantly higher in the no-gestures condition than the no-sound ($z = -3.823, p < .001, r = .493$). Results also showed that infants had significantly more Stunned Expressions in the no-sound compared to the normal condition ($z = -2.546, p = .001, r = .328$), and in the no-sound compared to no-gestures ($z = -3.453, p = .001, r = .445$). No significant increase in Stunned Expression was found in the no-gesture ($z = -.577, p = .564$) compared to the normal condition.
Table 3.3. *Means and standard deviations of relative behavioural frequencies*

<table>
<thead>
<tr>
<th>Behavioural Measure</th>
<th>Normal</th>
<th>No-gestures</th>
<th>No-sound</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
</tr>
<tr>
<td>Limbs Movements</td>
<td>25.9</td>
<td>9.49</td>
<td>18.20</td>
</tr>
<tr>
<td>Gaze Away</td>
<td>1.20</td>
<td>0.96</td>
<td>1.65</td>
</tr>
<tr>
<td>Positive Affect</td>
<td>2.85</td>
<td>1.31</td>
<td>1.90</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>0.50</td>
<td>0.29</td>
<td>0.75</td>
</tr>
<tr>
<td>Stunned Expression</td>
<td>0.21</td>
<td>0.09</td>
<td>0.35</td>
</tr>
</tbody>
</table>

*Note.* The maximum duration of the games in every condition was 30 seconds, thus each behavioural measure may range from 0 to 30.
3.4. Discussion

The present study explored early play routines of 3-month-old infants and their mothers, and observed the infant’s behaviour when these routines were disrupted. As there is very little literature about early play routines, our aim was firstly to describe them in order to understand their structure, and what kind of participatory affordances do they offer to infants.

In addition to this we wanted to observe whether the infants’ participatory behaviour would change as a result of unexpected alterations of the game. Our analyses showed that when the game was violated with sound and gesturing disjointed (in both the no-gestures and no-sound conditions), the majority of infants significantly decreased their movements, gazed away from the mother more often and decreased their positive affect display. Furthermore, they presented increased Stunned Expressions, especially when the game was played without any sound. Overall, we can argue that the infant’s participation in the game was poorer in the altered conditions. A possible explanation for this may be that infants are more likely to experience interactions that are coordinated at the motor-auditory level, involving sounds without gestures, rather than gesturing movements not accompanied by any vocalisation (Mehus, 2011). Yet, these findings may lead to different interpretations. On the one hand, violations may have not been recognised as such, but simply experienced as different, less engaging activities than the fully enacted games. Or, infants might have become tired or bored as the procedure went on, and therefore engaged less. Support for this interpretation comes from absence of any signs of distress (in terms of
Negative Affect), as typical when expectations are violated, and presence of some signs of inattention (such as Gaze Away). Yet, this would not explain why infants showed more Stunned Expressions.

An alternative interpretation which may be advanced is that infants’ decreased their participation by smiling and laughing less, showing increased Stunned Expressions and being more bodily still, as the result of confusion for something ambiguous that did not match their usual experience (Tronick et al., 1978). According to this interpretation, infants may have developed expectations regarding how the mother usually behaves in such specific interactions, which in turn affected the quality of their participation when the familiar game was violated. We support this second alternative. The most persuasive evidence for it is infants’ dramatic behavioural change in the altered conditions even if the mother had not withdrawn from the interaction and was still offering some level of stimulation. This represents a point of difference with most of the research using violation paradigm, in which the adult interrupts an initiated interaction or strongly reduces her interactional engagement (by suspending the gesturing or singing). A weakened engagement in the game and –even more importantly- the loss of its playful quality, as shown by the decrease in positive affect, might mean that the infants were not so much affected by a lack of maternal contingency or affective attunement, (as observed in many contingency violation studies1) but rather by alterations of an established game structure. If this interpretation is correct, play routines may constitute early interactional contexts on which infants have expectations as structured units of coupled auditory and motor resources. Past research has revealed an aspect of ‘trans-modal’ musicality in early conversations and games built on the precise time coordination between voice and actions, which supports the intersubjective engagement (Trevarthen, 1999).
Observing the games structures, we found that they provide the infants with multiple opportunities of engaging in the interaction. Furthermore, they seem to represent a “ready-to-use”, interactive tool for parents. We think that compared to free play, these structures enable and sustain the infant’s participation in the interaction for long periods, supporting the development of interactive competences of reading complex communications. Surprisingly, the games we observed presented similar lengths and format even if their structure differed, suggesting that they may respond to specific developmental needs: to be entertaining for the infant, to facilitate an affective and pleasant experience between the infant and the mother, and have a flexible structure to be adapted to the baby’s emerging capacities (cognitive, attentional, motor capacities). As routines, these games may also have a developmental function: conceiving a routine, whatever that might be, as a sequence of recognisable tasks-so-far (Lerner et al., 2011) enables its understanding as based on a situated, practical grasp of that routine instead of relying on some cognitive representation of it. In other words, it may enable infants of being capable partners in joint actions (as they recognise and have expectations on it) even without possessing higher-level social knowledge. Under this view, infants are not passive recipients of actions performed on them, but rather capable of active participation in any joint routine. Play routines might also represent early communicative contexts which prepare the ground for later, more complex multimodal interactions, such as verbal exchanges (Bruner, 1975; Bullowa, 1979).

Infants’ development in the first year shows how being involved in the expressions and emotional transformations of vocal games can facilitate interest in sharing meanings (Trevarthen, 1999). As Goodwin (2013) has proposed, interactions are co-operative and transformative in the sense that “Actors can build new action by selectively reusing resources provided by a prior action” (p. 1), suggesting that if interactions are constructed
out of different resources then even non-verbal participants may co-contribute to the building up of an interaction. Multimodality can be therefore framed as structuring and facilitating early interactions through co-participation.

3.5. Conclusions

Whatever interpretation we support, this study has led us to reflect about how an embodied participation in joint routines generates expectations on the partners’ mutual commitment to participate in a certain - though not identical – way. The pleasure of participating seems at least partially conditional to recognising the moves in the sequence and being therefore able to cooperate to and in it. Since this is the first work to explore early structured play, it also presents various limitations. For instance, to endorse an ecological approach and explore how early social games worked in the first place, we decided not to constrain mothers to play a specific game but rather focus on their spontaneous way of playing. This is why only the two violated conditions have been counterbalanced, but not the normal one. We preferred to always start with the normal game to preserve (and grasp) the infant’s spontaneous engagement with a familiar routine, which would not be possible if we started with the other conditions.
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4. EXPLORING INFANTS’ SENSITIVITY TO DELAY DURING A PICK-UP ROUTINE

Abstract

Infants actively participate in the joint routine of being picked up by an adult, making the interaction smoother and more effective. The aim of the present study was to investigate infants’ responses to a delay in the flow of the pick-up sequence. Twenty-three 3-month-old infants were observed during natural interactions with their mothers, where mothers were instructed (1) to pick up their infants as they usually did, and then (2) to delay the pick-up for 5 seconds after placing their hands on the infant’s waist. In both normal and delayed pickup episodes we coded infant’s Body Tension, gaze and affective expressions during three phases: Approach, Contact and Lift. Additionally, we measured infants’ Head Lag during Lift. Results showed that during normal pick-up infants displayed higher Body Tension, more Positive Affect, a tendency to look longer at the mother’s face and a smaller Head Lag during Lift. During delayed pick-up infants showed lower Body Tension and more signs of distress, shifted their gaze Away from the mother’s face and increased the Head Lag during Lift. These findings suggest that infants are capable of real time adjustments to maternal behaviours which ease the pick-up interaction, as they recognise her intentions-in-actions. Additionally, these findings suggest that infants are cooperatively participating in the joint routine of being picked up.
Cooperating is a fundamental way of doing things with others that we learn from very early on, and many researchers from philosophy and psychology have investigated its emergence during childhood. Mainstream accounts of cooperation have depicted the ability to cooperate as depending on inferential abilities, proposing that participants engage in cooperative actions only if they are able to infer each other’s thoughts and plans, and combine them to build their co-actions to successfully achieve a common goal (Bratman, 1992; Tuomela, 1993, 2005; Gilbert, 2000; Pacherie, 2006). However, this view presupposes a propositional knowledge of others’ intentions and relational experience, which are too sophisticated psychological concepts to study how cooperation emerges developmentally (Tollefsen, 2005; Butterfill, 2012; Fantasia, De Jaegher, & Fasulo, 2014).

Alternative approaches focusing on embodied experiences of interactions have suggested that intentions are “visible” through observing others’ movements (Reddy, 2008; Tollefsen & Dale, 2012; Ansuini, Cavallo, Bertone, & Becchio, 2014), which implies a fundamental reformulation of the concept of cooperation and its development in infancy. Accordingly, to understand others’ intentions requires experience with others’ actions, through observation and participation, which is something that even infants do daily. In this paper we examined 3-months-old infants’ sensitivity to caregivers’ intentions-in-action during a pick-up interaction. By showing that infants adjust their actions according to their caregivers’ behaviour during this early cooperative routine, we aim to provide evidence for the argument that understanding others’ intentions may not necessarily require complex inferential abilities, but rather is embedded in the embodied participation in joint routines.
Joint routines are recurrent interactions which infants experience from their very first days of life. In fact, starting at birth infants are involved in goal-directed routines scaffolded by their caregivers, such as having a diaper changed (Nomikou & Rohlfing, 2012), being fed (Kochukhova & Gredebäck, 2010), playing (Bruner & Sherwood, 1976; Ratner & Bruner, 1978; Fantasia, Fasulo, Costall, & López, 2014) and being picked up (Reddy, Markova & Wallot, 2013). These routines are often structured through repetitions of action sequences (often with or on objects), and performed at particular times and in particular places, with some variability depending on the routine. These routine interactions are also dynamic and thus require continuous adjustments and physical coordination between the mother and the infant (Stern, 1974; Bruner, 1975). Such extensive practice in coordinating with others’ movements and objects (as, for instance, in the case of diaper changing or dressing) arguably has an impact on infants’ general development, because it provides, for instance, opportunities for manual exploration and reaching (Adolph, Karasik, & Tamis-LeMonda, 2012), and increases the infants’ sensitivity to the caregivers’ structured actions (Noumikou & Rohlfing, 2011; Hilbrink et al., 2014). Furthermore, routines support the exploration of affective and motor contingencies, and thus allow infants to form expectations about others’ behaviour (Lamb & Malkin, 1986; Ross & Lollis, 1987; Legerstee & Markova, 2007; Gredebäck & Melinder, 2010; Fantasia et al., 2014).

Because routines are built up around turns of action, they resemble early dialogues between infants and caregivers, thus grounding the emergence of communicative skills in infancy (Berducci, 2010; Lerner, Zimmerman, & Kidwell, 2011). In fact, caregivers usually consider infants as competent interactants (Bruner, 1975; Vedeler, 1993; Raczaszek-Leonardi, Nomikou, & Rohlfing, 2013). In many ways, being involved in joint routines
increases and supports the infants’ emergent social and cognitive development (Hubley & Trevarthen, 1979; Hubley, 1983).

Recent evidence shows that even 2-month-old infants are able to make specific postural adjustments when mothers approach to pick them up (Reddy et al., 2013), if caregivers’ kinematic approach is clear and visible so that infants are given time to recognize the action and prepare for it (Fogel, 1993). At 5 months of age, and even at 3 with previous experience, infants are able to determine the goal-directedness of human action (Woodward, 1998; Sommerville, Woodward, & Needham, 2005), and at around 6 months infants are able to anticipate the goals of observed actions, such as the target of a grasping hand (Falck-Ytter, Gredebäck, & von Hofsten, 2006; Kanakogi & Itakura, 2011; Ambrosini, Reddy, de Looper, Costantini, & López, 2013), and to discriminate different intentions of other people (Marsh, Stavropoulos, Nienhuis, & Legerstee, 2010). This suggests that infants can discriminate between movements performed with different intentions, particularly when these movements are embedded in familiar actions.

As a routine, being picked up enables infants to form expectations about the caregivers’ actions (Service, 1984; Reddy et al., 2013), or the contingencies in which these actions would occur, as shown by 4- to 5-month-old infants’ expectation to be picked up when distressed (Lamb & Malkin, 1986). At around 6 to 7 months of age infants request to be picked up by lifting their arms up in response to mothers’ approach (Lock, 1984), although this response is strongly affected by maternal style of picking up, and communication in general (Service, 1984). These results suggest that infants understand other’s intentions as observable actions during pick-up interactions and respond accordingly.
However, having expectations and anticipating the other’s movements is one step on the way to understanding others’ intentions, but it is different from cooperatively participating in an interaction. The question of how infants contribute to a joint routine and whether they cooperate in it is still open. Some studies have investigated early cooperative skills in young children by adopting specifically designed laboratory tasks involving role reversal, problem-solving or simultaneous coordination of movements (e.g., Brownell & Carriger, 1990; Warneken, Chen, & Tomasello, 2006; Warneken, Gräfenhain, & Tomasello, 2012). In these studies, successfully performed joint tasks set the age threshold for attributing cooperative abilities and instrumental helping to children; yet, due to their task demands they cannot be applied with very young infants, and thus do not allow to investigate possible earlier forms of cooperative participations.

The goal of the present study was to examine whether and how infants cooperatively participate in a pick-up interaction. We first observed 3-month-olds and their mothers during a natural sequence of picking up and putting down and then asked mothers to delay the pick-up sequence after having contacted the infants’ waist. Following previous research showing that infants facilitate and contribute to the pick-up episode by stiffening their bodies (Reddy et al., 2013) we hypothesised that a delay in the pick-up episode would affect the infants’ cooperative participation, defined as body tension, head alignment with the body and gaze to the mother. We expected that infants would hold their body tensed and head aligned to the body to ease the interaction in the normal pick-up, but they would lose this tension when the pick-up sequence was delayed.
4.2. Method

Participants

Twenty-three 3-month-old infants (10 girls, $M_{\text{age}} = 96.04$ days, $SD = 3.92$ days) participated in the study. All infants were healthy at birth, Caucasian, and came from lower to middle class families, as determined by parental reports on years of education. Maternal age at time of birth ranged from 26 to 37 years ($M_{\text{age}} = 31$ years, $SD = 3.17$ years). Volunteer parents were recruited through different family centres, nurseries and pre/antenatal classes in town. Two dyads were excluded from the original sample of 25 infants due to the infants’ fussiness and lack of interest during the procedure.

The *Bayley Scales of Infant Development* – Second Edition (BSID-II; Bayley, 1993) were used to control for infants’ motor maturity, cognitive skills and equivalent developmental age. One infant scored lower than one percentile under the average on the Mental Scale (Mental Index score = 82). However, this infant’s behavioural responses were not different from the average responses of the other infants in the sample, thus this infant was included in the final sample.

Materials and Procedure

Mother-infant dyads were observed in a quiet, spacious room at the University Infant laboratory, at a convenient time for the mothers. Prior to the start of the testing session mothers signed a written informed consent and were asked whether their infants appeared to be showing any anticipation of their actions in general and, more specifically, of impending picks-up in various situations. Then the experimenter and the infant played for approximately 3 to 5 min to familiarise the infant with the setting before administering the
BSID. The BSID average assessment length was 12 min, and then the testing began. Infants were laid down on a Tekscan sensor mat (47 cm x 47 cm), which was placed on a plastic changing mat on a low table (36 cm off the floor). Interactions were filmed with a digital camera that focused on the infant (recording at 30 frames per second).

All dyads were observed in two conditions: (1) normal and (2) delayed pick-up episodes. In the normal pick-up episode, which was always tested first, mothers were instructed to chat with their infants and pick them up a few times during the interaction whenever they felt infants were comfortable and attentive, ensuring that the infants could see their arms as they approached to pick them up. To choose one of the pick-up episodes to be coded in this condition, we applied the same criteria described by Reddy et al. (2013). There was disagreement about the criteria in two cases, which was resolved following re-viewing of the video material.

Following the normal pick-up, mothers were asked to repeat the same procedure, except that they were instructed to delay the pick-up after placing their hands on the infants’ waist, and hold it for approximately 6s. After 6s of delay the experimenter signalled to mothers to complete the picking up sequence, by snapping her fingers. Because our aim was to violate infants’ expectations, the delayed pick-up was only tested once for each dyad and always following the normal pick-up. In one case, however, the mother had to repeat the delayed pick-up procedure due to the infant’s fussiness.

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7The Tekscan sensor mat consists of pressure sensors with a sampling rate of 20 Hz. Although the sensor mat was part of the testing procedure, the data extracted from it are not used in the present study.
Measures

Identifying phases within pick-up episodes. Three phases were identified for each normal and delayed pick-up episodes: (1) Approach: beginning from the onset of the mother’s arms starting to approach the infant until Contact; (2) Contact: beginning from the onset of the mother’s hands contacting the infant’s waist until the onset of Lift; (3) Lift: beginning from the movements of mother’s hands on the infant’s waist until the infant’s body was completely detached from the mat. Mean durations for each of these three phases were as follows: Approach = 2.49s, Contact = 2.05s and Lift = 1.54s in the normal condition, and Approach = 1.55s, Contact = 8.32s and Lift = 1.48s in the delayed condition. Repeated-measures ANOVAs were performed to compare the duration of each phase, with condition as the within-subjects factor. Results showed that both the Approach and Contact phase durations were longer in the normal condition compared to the delayed one, $F(1, 22) = 5.279$, $p = .031$, $\eta^2 = .194$, 95% CI [.09, 1.789] and $F(1, 22) = 195.93$, $p < .00$, $\eta^2 = .899$, [5.34, 7.2], while there was no significant difference in the duration of Lift phase between conditions, $F(1, 22) = .339$, $p = .566$, $\eta^2 = .015$, 95% CI [.172, .305]. The difference in Approach duration in the two conditions may be due the procedure order: Since the delayed condition was always presented after the normal one, mothers may have acquired familiarity with the procedure so that the second pick-up episode was generally quicker than the first one. A second possible explanation may regard an increase in the infants overall attentiveness in the delayed condition. Infants may have been more alerted and focused on the mother’s behaviour after the second pick-up episode. Thus, since we asked the mothers to pick their infants only when these were comfortable and attentive, the
mothers may have speeded up the approach in the second pick-up episode, as infants appeared more attentive from the beginning.

One coder viewed and identified the frame points for the onset of Approach and Contact, and onset and offset of Lift for all infants in both conditions (normal and delayed). A second coder independently viewed 25% of the video material in both conditions. The coders disagreed on two pick-up episodes out of 24 (within 10 video frames, i.e., at 30 fps, 1/3 of a sec). Coefficients of agreement for each phase and condition are presented in Table 4.1.
Table 4.1. *Intra-class correlations for all measures in the present study.*

<table>
<thead>
<tr>
<th>Measure</th>
<th>ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phases</td>
<td></td>
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<tr>
<td>Approach</td>
<td>1</td>
</tr>
<tr>
<td>Contact</td>
<td>0.999</td>
</tr>
<tr>
<td>Lift</td>
<td>0.998</td>
</tr>
<tr>
<td>Gaze</td>
<td></td>
</tr>
<tr>
<td>Mother’s Face</td>
<td>0.967</td>
</tr>
<tr>
<td>Mother’s Body</td>
<td>0.861</td>
</tr>
<tr>
<td>Away from Mother</td>
<td>0.913</td>
</tr>
<tr>
<td>Body tension</td>
<td>0.97</td>
</tr>
<tr>
<td>Head Lag</td>
<td></td>
</tr>
<tr>
<td>Beginning</td>
<td>0.996</td>
</tr>
<tr>
<td>Halfway</td>
<td>0.998</td>
</tr>
<tr>
<td>Affects</td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>0.906</td>
</tr>
<tr>
<td>Negative</td>
<td>1</td>
</tr>
</tbody>
</table>

*Behavioural coding.* A pick-up routine mainly involves physical contact and bodily adjustments (Service, 1984; Reddy et al., 2013). Infants’ motor behaviour is thus a crucial index of their involvement and contribution to the pick-up sequence. Therefore, we measured the duration of infants’ *Body Tension* as periods involving the co-occurrence of arms stretched out and legs either extended and stiffened or tucked in. In order to measure infants’ social involvement, we coded the durations of *Gaze to Mother’s Face, Gaze to Mother’s Body or Gaze Away,* and frequency of *Positive* and *Negative Affect.* *Positive Affect* was defined by smiles (raised cheeks and corner of lips turned up with mouth open or
closed) and laughs (raised cheeks, mouth open, lower and upper gum visible, eyes open or winked, possibly accompanied by some vocalisations), whereas Negative Affect was defined by frowns (furrowed brow and downturned mouth) and sad expressions (mouth, eye brows and cheeks turned down) (see also Legerstee & Markova, 2007).

Previous research has shown that infants tend to look longer to their partner or shift their gaze frequently in response to unexpected behaviours (Phillips, Baron-Cohen & Rutter, 1992; Bertin, Striano, 2006). To investigate whether infants would try to disambiguate the mother’s behaviour when the pick up was delayed (which is indeed a rather ambiguous situation) we measured how many times the infants shifted their gaze from the mother’s face to away and from the mother’s face to the mother’s body. Durations (for Body Tension Gaze to the Mother) and frequencies (for Positive and Negative Affect and Gaze Shifts) were adjusted according to the duration of each phase in both conditions. Only these relative frequencies and durations were used for further analyses.

Reddy et al. (2013) reported that when approached to be picked up infants sometimes turned their head or raised the chin, strengthening the neck, reducing its lag, and thereby facilitating the lift. To include a measure of infants’ head-neck strength facilitating the caregivers’ movements and thus contributing to the pick-up, we observed infants’ Head Lag during the Lift phase in both normal and delayed pick-up. Using Dartfish, a video analysis software, we calculated the angle between chin, chest and neck border for each infant at two points: beginning of Lift (i.e., corresponding to the onset of the Lift phase)
and halfway through Lift\(^8\) (i.e., midpoint in time of the Lift phase). The beginning of the Lift was used as a baseline to control for each infant’s individual angle when the head was leaning on the mat. If infants’ head dropped backward during the Lift (i.e. Head Lag), then this resulted in an increase of the measured angle at the midpoint of the Lift phase. We hypothesised that the Head Lag would increase in the delayed compared to the normal pick-up, because the delay may leave infants unprepared to be lifted, and thus decreasing their neck strength.

Infant behaviours were coded by one observer blind to the rationale of the study. A second observer independently coded 25% of the video material in both conditions. Episodes were watched at least twice: initially at normal speed to identify relevant behaviours, and then frame by frame to identify onset and offset points of behaviours. Inter-observer reliability was assessed using the Intraclass Correlation Coefficient, and values ranged from .861 to 1 (see Table 4.1.).

4.3. Results

Means and standard deviations for all infant behaviours are presented in Table 3.2. Repeated-measures ANOVAs were computed separately for Body Tension, Positive and Negative Affect, and Gaze at the Mother’s Face with condition (normal, delayed) and phase (Approach, Contact, Lift) as the within-subjects variables. Pairwise comparisons were adjusted with a Bonferroni correction. The results showed a significant main effect of

\^8 In order to take into account individual variations in the Lift phase duration, we chose a time criterion to determine the exact point to measure infants’ head lag, that is the midpoint in the duration of each individual lifting phase.
condition for Body Tension, $F(1, 22) = 24.48, p < .001, \eta^2 = .527, 95\% \text{ CI} [.120, .294]$, and a significant interaction between condition and phase, $F(2, 44) = 8.828, p = .001, \eta^2 = .286$. Simple contrasts revealed that there was an increase in Body Tension from Approach to Contact in the normal condition ($p = .016, 95\% \text{ CI} [-.397, -.035]$), while there was a decrease from Approach to Lift ($p = .012, 95\% \text{ CI} [.055, .513]$) as well as from Contact to Lift ($p = .004, 95\% \text{ CI} [.065, .381]$) in the delayed condition (Figure 4.1).

![Figure 4.1](image)

*Figure 4.1.* Mean relative durations of Body Tension across the three phrases in normal and delayed pick-up episodes.

There was a significant main effect of condition for Positive Affect, $F(1, 22) = 4.957, p = .037 \eta^2 = .184, 95\% \text{ CI} [.03, .89]$ and Negative Affect, $F(1, 22) = 6.583, p = .018, \eta^2 = .23, 95\% \text{ CI} [.66, .07]$, indicating that infants showed more positive affect during the normal than the delayed pick-up, and more negative affect during the delayed than the normal pick-
Moreover, there was a significant main effect of phase for positive affect, $F(2, 44) = 6.235, p = .004, \eta^2 = .221$, indicating that, in both conditions, infants displayed significantly less positive affect during Lift compared to Approach ($p = .016, 95\% \text{ CI} [.15, 1.71]$) and Contact ($p < .001, 95\% \text{ CI} [.43, 1.42]$).

There was also a marginally significant main effect of condition for Gaze to Mother’s Face, $F(1, 22) = 3.456, p = .076, \eta^2 = .136, 95\% \text{ CI} [-.02, .27]$, suggesting a tendency for infants to look longer at their mothers’ face during normal than during delayed picks-up.

A repeated-measures ANOVA with frequency of Gaze Shift directions (face-to-mother’s body and face-to-away), condition (normal, delayed) and phase (Approach, Contact) as the within-subjects factors. Results showed a significant main effect of phase, $F(1, 22) = 15.39, p = .001, \eta^2 = .412, 95\% \text{ CI} [.14, .45]$, and condition, $F(1, 22) = 42.73, p < .001, \eta^2 = .66, 95\% \text{ CI} [.39, .76]$, as well as a significant interaction between phase and condition, $F(1, 22) = 16.61, p = .001, \eta^2 = .43$. Simple contrasts indicated that there was no difference between Approach and Contact in the normal pick-up ($p = .852, 95\% \text{ CI} [-.44, -.52]$), but a significant increase in gaze shifts from Approach to Contact when the pick-up was delayed, $F(1, 22) = 37.66, p < .001, \eta^2 = .631, 95\% \text{ CI} [-1.63, -.81]$. No effect of gaze shift direction was found.

Finally, to compare infant Head Lag before and during Lift in the two conditions a repeated-measures ANOVA was computed with condition (normal, delayed) and time (beginning lift, midway lift) as the within-subjects factors. Results revealed a significant main effect of condition, $F(1, 22) = 17.94, p < .001, \eta^2 = .449, 95\% \text{ CI} [4.81, 14.04]$, and time, $F(1, 22) = 126.58, p < .001, \eta^2 = .852, 95\% \text{ CI} [15.80, 22.94]$, as well as a significant interaction between condition and time, $F(1, 22) = 26.32, p < .001, \eta^2 = .545$ (see Figure
Simple contrasts showed that there was no difference between the conditions at the beginning of the lift ($p = .291, 95\% \text{ CI} [-7.32, 2.30]$). However, halfway through the lift infant head lag was significantly higher in the delayed than the normal pick-up, $F(1, 22) = 32.73, p < .001, \eta^2 = .598, 95\% \text{ CI} [-22.28, -10.42]$, suggesting that infants’ head had lost its strength and was not aligned with the body when the pick-up was delayed.

![Figure 4.2](image.png)

**Figure 4.2.** Mean Head Lag angles at the beginning and midpoint of Lift in normal and delayed pick-up episodes.
**Table 4.2. Descriptive statistics for all measures in both conditions and phases**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Normal</th>
<th>Delayed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Body Tension (relative duration)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approach</td>
<td>0.39</td>
<td>0.30</td>
</tr>
<tr>
<td>Contact</td>
<td>0.61</td>
<td>0.22</td>
</tr>
<tr>
<td>Lift</td>
<td>0.65</td>
<td>0.33</td>
</tr>
<tr>
<td>Head Lag (angle)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beginning Lift</td>
<td>76.63</td>
<td>13.45</td>
</tr>
<tr>
<td>Midpoint Lift</td>
<td>89.08</td>
<td>13.92</td>
</tr>
<tr>
<td>Positive Affect (relative frequency)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approach</td>
<td>1.33</td>
<td>1.92</td>
</tr>
<tr>
<td>Contact</td>
<td>1.39</td>
<td>1.61</td>
</tr>
<tr>
<td>Lift</td>
<td>0.27</td>
<td>0.62</td>
</tr>
<tr>
<td>Negative Affect (relative frequency)</td>
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<td></td>
</tr>
<tr>
<td>Approach</td>
<td>0.19</td>
<td>0.79</td>
</tr>
<tr>
<td>Contact</td>
<td>0.01</td>
<td>0.06</td>
</tr>
<tr>
<td>Lift</td>
<td>0.16</td>
<td>0.46</td>
</tr>
<tr>
<td>Gaze Shifts from Mothers’ Face to Away (frequency)</td>
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<td></td>
</tr>
<tr>
<td>Approach</td>
<td>.43</td>
<td>.66</td>
</tr>
<tr>
<td>Contact</td>
<td>.30</td>
<td>.47</td>
</tr>
<tr>
<td>Gaze Shifts from Mothers’ Face to Mothers’ Body (frequency)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approach</td>
<td>.26</td>
<td>.45</td>
</tr>
<tr>
<td>Contact</td>
<td>.35</td>
<td>.49</td>
</tr>
<tr>
<td>Gaze to the Mothers’ Face (relative duration)</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>0.33</td>
</tr>
<tr>
<td>Contact</td>
<td>0.61</td>
<td>0.32</td>
</tr>
<tr>
<td>Lift</td>
<td>0.58</td>
<td>0.36</td>
</tr>
</tbody>
</table>
4.4. Discussion

The results of the present study add to the picture of infants’ capacity to anticipate a pick-up episode presented by Reddy et al. (2013), suggesting that from very early on in life infants not only understand others’ intentions-in-action directed to the self, but also functionally adjust to them. Our goal was to determine whether infants’ bodily adjustments might hold a cooperative function in an early routine, such as being picked up. Our results indicated that infants increased their body tension as the pick-up interaction unfolded normally, during which they also displayed more positive affect and tended to look longer at the mother’s face. As predicted, when the pick-up was delayed infants responded by decreasing their body tension and head-neck strength (i.e., increase of the Head Lag angle), shifting their gaze away from the mother’s face, either to the periphery or to her body, and expressing more signs of distress.

If we consider an interaction as cooperative when each of the subjects is acting to complement the other’s response (Hubley & Trevarthen, 1979), then our findings strongly suggest that infants’ behaviour was cooperative to the extent that they stiffened their body and supported their head contingently, complementing and easing the mother’s movements. Moreover, in line with previous findings on infants’ response to violations of expectations (Tronick, Als, Adamson, Wise, & Brazelton, 1978; Lamb & Malkin, 1986; Camras et al., 2002; Fantasia et al., 2014), when the pick-up sequence was delayed the infants’ body was limp and the head released backward. In a way it seemed that infants were losing their preparedness to be picked up, and thus stopped contributing to the action. Consequently, it could be argued that infants did not simply react to an invitation for being picked up, but also regulated their participation in it through online adjustments of their bodies. This
dynamic may result in a unique matching between maternal style of picking up and the infant’s response to it (Service, 1984).

Previous research demonstrated that from the beginning of life infants experience reciprocal, contingent and affective exchanges with caregivers (Brazelton, Koslowski, & Main, 1974). When these affective or temporal contingencies are disrupted, infants show signs of distress and negative affect (see Adamson & Frick, 2003, for a review). Similarly, early routines represent recurrent actions that may easily generate expectations about maternal behaviour or the interactional sequence, and whose disruption causes increasing negative affect and lack of cooperation, as the results of the present study show. Moreover, previous studies reported an increase in infant gaze to an adult’s face when their expectations were violated (Phillips, Baron-Cohen, & Rutter, 1992; Behne, Carpenter, Call, & Tomasello, 2005; Marsh et al., 2010). In light of this evidence, our finding that infants showed a tendency to look longer at their mothers’ faces during the normal pick-up seems counterintuitive. However, we also found an increase in gaze shifts from Approach to Contact during the delayed pick-up which could be interpreted as an attempt to disambiguate the mother’s behaviour. Yet, since these shifts were equally distributed between gaze away and to the mother’s body, it is difficult to specify their exact function. One possible explanation could be that infants disengaged from the interaction to avoid distress (as proposed by previous studies using the Still Face paradigm). Alternatively, gaze shifts may be an attempt to grasp and share the mother’s attention in an ambiguous situation (Amano, Kezuka, & Yamamoto, 2004), and thus allow infants to track their mothers’ action and try to make sense of it.

Whichever interpretation one favours, our findings suggest that 3-month-old infants have some knowledge about how a pick-up routine is structured and sequenced, which
enables them to anticipate its occurrence and support it with their movements. This is in line with previous findings showing that 3-month-old infants have expectations about the structure of early play routines (Fantasia et al., 2014), and that by 8 months of age infants can detect invariant elements in segmented words, showing an early sensitivity for structures involved in linguistic systems (Saffran, Aslin, & Newport, 1996; Baldwin & Baird, 2001). What are the implications of the present findings?

A first major implication is that infants are clearly not passive recipients of actions performed on them, but rather sensitive participants when being picked up. Of course, should an adult decide to pick up an infant against her or his will, she would easily succeed without much effort. Yet, the motivation and pleasure achieved through this interaction might probably not be the same, as infant responsiveness and engagement during the pick-up is arguably crucial in its potential for motivating the caregiver and fostering the intersubjective exchange. Infants’ participation may even be considered a requisite for social development. As Berducci has proposed (2010), caregivers incorporate infants into interactions by acting on their natural responses, and structuring those into meaningful sequences of turn-taking and actions. Without infants’ active responsiveness the entire process of interactive co-construction would not exist.

A second major implication is that our results strongly support a more basic and developmental approach to cooperation (Fantasia et al., 2014), which takes into account infants’ daily shared practices without appealing to inferential knowledge or attribution of intentions. Indeed, intentions are manifested in observable behaviours as they dynamically take shape in interactions (Duranti, 1997); what makes behaviours (and thus intentions) predictable for infants is the experience of moving together, participating in the interaction by progressively coordinating and adjusting with the caregiver’s actions. As Fogel and
Thelen (1987) have proposed, social behaviour (and thus, intentions and goals) is not behaviour towards but mostly behaviour with others. Doing things together is a fundamental way of understanding and knowing others, their thoughts, intentions or emotions (McGeer, 2001; Zahavi, 2006; Reddy, 2008; Costall, 2013). Being picked up is an action involving physical contact and motor coordination. As suggested by Trevarthen (personal communication, 2015), any manipulation of the body by another, even touch or a handshake, will excite proximal, proprioceptive (as well as visceromotor, internal) sensations of the receiver person. Multimodality is a manifestation of the adaptive ‘autopoiesis’ of the body and the ‘integrative action of the nervous system’ (Sherrington, 1906), which maps the body’s potentialities for motor action of many parts with multisensory ‘experience’ (Trevarthen, 2011). In interactions, this experience is fundamentally shared through coordination with other’s movements and possibilities for action.

Some limitations of the present study may affect the interpretation of the results. First, the fixed order of conditions (i.e., normal the pick-up was always performed first) may have influenced infants’ responses to the subsequent delay in the pick-up sequence by, for example, increasing the infants’ attention to the violation of the usual way they are picked up. On the other hand, asking mothers to introduce a delay in their natural pick-up routine before picking up their infants may have thwarted their naturally-occurring behaviours. Second, being picked up twice within a relatively short period of time may have taken toll on infants’ attentiveness, resulting in the overall decrease of participation showed by infants in the delayed pick-up episode. However, our results indicate that infant behaviours were comparable in the approach phase of both conditions, and only during contact infants began realising that ‘something is not quite right’. Finally, our study design did not allow us to determine the precise point in which infants detected a delay in the pick-
up flow and changed their behaviour. This is problematic, conceptually as well as practically, because infants could make allowances for the delay by expecting to be picked up for some time and thus behaving as if the pick-up was not delayed. It could be argued that by analysing the whole phase where the change occurs (i.e., contact phase), and not a specific time period (e.g., period between when the infant would normally have been picked up until it eventually was), we accounted for these individual allowances, and thus consider this a conservative approach.

4.5. Conclusions

Our primary interest in this study was to explore infants’ behaviour in terms of participation in a normal pick-up episode, and their responses to violations of the pick-up sequence. With this aim in mind, we needed to make the normal pick-up as appealing as possible, avoiding any possible additional fatigue or stress caused by experiencing a violation of expectations. However, future research will need to take these limitations into account. It would be interesting to investigate possible individual differences in infant’s compliance with the adult’s pick-up action as early signs of lack of interest in engagement and thus psychopathology.

To conclude, our results suggest that the observation of infant behaviour in daily, familiar practices, such as routines, may reveal aspects of infants’ participation as competent and functional, which may not otherwise be observed in other (more artificial) contexts.
References


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5. RETHINKING INTRUSIVENESS IN POSTPARTUM DEPRESSION

A Sequential Analysis of Mother-Infant Interactions

Abstract

Coordination and alignment are fundamental features in the building up of mutual, sequentially organised interactions. The focus on mutual regulation and optimal range of stimulation in mother-infant interactions has led research to investigate the cases in which difficulties in the maternal behaviour may not support the infant’s experience of participation, e.g. maternal intrusiveness. Intrusiveness is presented here in its different descriptions as behavioural category, assigned by mainstream research on clinical and non-clinical populations. In other words, intrusiveness has often been operationalised as a pre-defined set of maternal behaviours, coded independently from the infant’s behaviour and the broader interactional context. The aim of the present work is to investigate 1) the consistency of these behavioural categories and 2) their efficacy in analysing the interactional dynamics constituting maternal intrusiveness (namely, those specific maternal conducts that restrict the infant’s participation in interaction). A microanalysis inspired by Conversation Analysis methods was applied to selected episodes of face-to-face interactions between mothers and their 3-months-old infants. Through this analysis, interactional dimensions such as persistency, alignment, sequential structuring and timing emerged and appeared to be essential elements for the interactional organisation, supporting (or reducing) the infants’ participation.
5.1. Introduction

The experience of interactive coordination and affective alignment with the caregiver supports the infant communicative development and socialisation (Lamb, Bornstein, & Teti, 2002; Tronick & Beeghly, 2011). Coordination and alignment are fundamental features in the building up of mutual, sequentially organised interactions, where caregivers treat the infant as an agentful participant while interacting (Rączaszek-Leonardi, Nomikou & Rohlfing, 2013). Exploring how coordination works is crucial to the understanding of typical and atypical developmental trajectories (Fogel, 1992; Tamis-LeMonda, Bornstein, & Baumwell, 2001; Stern, 2002; Reddy, 2008). The sequential organisation of early joint routines supports the creation of regular interactional sequences, in which the caregiver contingently acts upon the infant’s action and incorporates it into a conversation-like interaction (Berducci, 2010). Different modalities of interactional organisation configure opportunities to participate for the infant, either in a supportive or restraining way.

The caregiver’s role in this dynamic process is essential. The mother’s behaviour has been explored for its impact on the quality of early intersubjective relationships. In particular, research on clinical populations, and especially on postpartum depressed mothers, has focused extensively on maternal intrusiveness (Cohn & Tronick, 1983), broadly described as a maternal conduct which interferes with the infants’ participation in dyadic interactions.

The overarching purpose of this paper is to explore what happens, from an interactional point of view, when mothers adopt a behaviour identified as intrusive according to coding systems widely used with clinical populations; and if, on the contrary, there are maternal behaviours which would not fall into these categories but nevertheless
appear to produce similar effects to those described in intrusive descriptions. To do so, we first briefly reconstruct the history of the development of this behavioural coding label, starting with the Mutual Regulation theory.

The Mutual Regulation Theory

One of the most recent and well established theories on early interactional dynamics is the Mutual Regulation Theory (Tronick & Cohn, 1989; Tronick & Weinberg, 1997). This model describes caregiver-infant interaction as constituted by patterns of reciprocal behaviours ranging from high affective coordination to affective disengagement. Under this account, interaction is a structured system of mutually regulated units of behaviour, as each partner’s behaviour is influenced and coordinated through the behaviour of the other (Tronick, Als & Adamson, 1979; Cohn & Tronick, 1988). Tronick and Weinberg (1997) later hypothesized that early difficulties in the experience of sharing and negotiating affects may disrupt the mutual regulatory process. Based on this theory, Tronick, Als & Brazelton (1980) developed a scoring system called Monadic Phase Paradigm (MPP).

The MPP consists of a descriptive analysis of face-to-face interactions which captures behavioural dimensions of the mother and the infant such as gaze direction, vocalisations, facial expressions, head orientation and body position, and combines them into macro-categories called monadic phases. Its categories code both the infant’s and the caregiver’s behaviour separately, and only subsequently link together on the basis of the time-based matching. Individual behaviours are therefore conceived as independent, as if the way partners respond to each other was not influenced by the other’s previous behaviour, and had no constitutive influence on the interactional unfolding.
**Intrusiveness**

The focus on mutual regulation and optimal range of stimulation in mother-infant interactions has led researchers to investigate the cases in which difficulties in the maternal behaviour may not support the infant’s experience of active participation, i.e. intrusiveness. Intrusiveness has often been described as involving

A constellation of insensitive, interfering parenting behaviors rooted in mothers’ lack of respect for their infants’ autonomy. Central to this conceptualization is the notion that the highly intrusive mother has her own agenda in mind as she either overwhelms the child with excessive stimulation or interrupts the child’s self-initiated activity to stop it or change its course (Ispa et al., 2004).

Initially, intrusive maternal behaviours have been described in terms of over-control and under-control (Ricks, 1981), and later on reframed as aspects of over-stimulation and directiveness (Pine, 1992). More recently, clinical researchers (i.e. in research on post-partum depression) have started to label as ‘intrusive’ a defined set of maternal behaviours, initially included in the Monadic Phase Paradigm (MPP). Behavioural categories such as anger/poke, disengage, elicit, play, originally described by the MPP, have been aggregated into macro-categories such as ‘disengaged’, ‘positive’, ‘mixed’ and used to classify behavioural patterns of the mothers. Intrusive behaviours were characterised by low levels of play and high levels of anger (Cohn et al., 1986; Cohn et al., 1990).

In few cases, mostly involving clinical populations, intrusiveness has been defined as an interactional style (often opposed to a withdrawn style) on the basis of ratings of the mother’s behaviour during an observed interaction (Malphurs et al., 1996a; Hatzinikolaou, 1997).
& Murray, 2010; Diego et al., 2002). Other studies, on the contrary, have attributed intrusive character to each single maternal behaviours occurring in a given time unit, such as rough handling of the infant, poking, pulling, tickling, interfering manipulation and using a loud tone of voice (Cohn et al., 1990; Diego et al., 2002; Malphurs et al., 1996b), and/or an angry tone of voice (Tronick and Weinberg, 1997). Overall, in this model the level of intrusiveness was determined by the amount of intrusive behaviours demonstrated by mothers.

A recent coding scale based on the MPP, the Infant and Caregiver Engagement Phases (ICEP, Weinberg & Tronick, 1999; adapted by Reck et al, 2011) has identified intrusive behaviours as those made regardless of the infant’s behaviour. Intrusive mothers are described by this instrument as “acting too loud, too expressively or too close to her child”. Despite its high level of details, in this coding scheme the judgment of whether a behaviour is intrusive or not seem to depend on the coder’s sensibility.

Stern (2002) argued that intrusiveness, is too large as a behavioural unit, too global and vague for clinical or observation purposes; unpacking “intrusiveness” into smaller behaviours, such as head turns, gaze aversion or speed of physical approach would instead lead to its better clinical understanding. For instance, he described the over-stimulating behaviour of one mother and her three-years-old daughter as related to a difficulty in recognising the child’ affective shift.

Whenever a moment of mutual gaze occurred, the mother went immediately into high-gear stimulating behaviors, producing a profusion of fully displayed, high-intensity, facial and vocal infant elicited social behavior. Jenny invariably broke gaze rapidly. Her mother never interpreted this temporary face and gaze aversion as
a cue to lower her level of behavior, nor would she let Jenny self-control the level by gaining distance (p. 135).

Stern seems to accept to use intrusiveness as a behavioural category, but highlights that maternal behaviours are dynamically influenced moment-by-moment by those of the child. Thus, maternal intrusiveness has to be observed and described in relation to the child’s behaviour. However, intrusive behaviours have often been described as maternal initiatives towards the infant, but rarely seen as responses elicited by the infant’s behaviour. Recent studies have investigated the influence of the infants’ conduct on the mothers’ intrusive behaviours, suggesting that these behaviours are not only expression of an individual maternal style, but also a response to different types of infant initiations (Bell & Chapman, 1986; Lloyd & Masur, 2014). For example, maternal intrusive utterances appeared more likely to be preceded by disengagements or attentional shifts by the infant (Masur, Flynn, & Lloyd, 2013). Beebe (2006) has argued that any intrusive behaviour on the mother’s side might be elicited by the infant’s withdrawn from the ongoing interaction, which in turn would foster a maternal intrusive response. In other words, maternal intrusiveness and infant withdrawal would represent two faces of the same interactional dynamic.

**Postpartum depression (PPD)**

Most of the past and current research investigating maternal intrusiveness has been applied in the study of clinical populations, particularly in the case of postpartum depression (PPD), as research in this field has also been influenced by the Mutual Regulation theory. PPD is a common psychological disorder that afflicts around 10% of new mothers (Cooper & Murray, 1997). Women suffering from this disorder typically
experience dysphoric mood along with other symptoms such as disturbances in sleep, appetite, psychomotricity, and they may have fatigue, guilt and suicidal thoughts (O’ Hara, 1997); it may have a prenatal onset and it usually lasts two to six months after birth (Cooper & Murray, 1997). Maternal depression may influence infants’ early interaction experiences and several studies have claimed its association with later difficulties in children’s emotional, cognitive and self-regulatory capacities (Murray, 1992; Murray & Cooper, 1997). Yet, the nature and extent of this influence is not fully clear and the literature on the topic is still controversial (Lovejoy et al., 2000; Murray et al., 1996).

Most of the studies exploring early interactions in the case of PPD described mothers' behaviour as either intrusive or withdrawn (Murray & Cooper, 1997). Intrusiveness in postpartum depression has been predominantly related to dimensions such as over-control and over-stimulation (Ricks, 1981). Another dimension often related is maternal sensitivity, defined as giving appropriate differentiating responses, the ability to get pleasure from the baby’s reciprocity and the initiation of interactions (Rutter, 1972), and directiveness (McDonald & Pien 1982; Pine, 1992). Beebe et al. (2008) have distinguished a specific aspect of physical behaviours, touch, as intrusive in some mothers with depressive symptoms. They suggested that mothers with depressive symptoms spent twice the time in intrusive touch as control mothers, decreasing their touch coordination with that of their infant and resulting in a more intrusive and less sensitively coordinated touch.

However, some inconsistencies have emerged in how intrusiveness has been described and later applied to research on clinical populations. Murray et al. (1996), for instance, distinguished sensitivity from intrusiveness, considering the former as mainly constituted by maternal warmth and acceptance, and the latter as observable in behaviours that physically restrain the child activity such as cutting across, taking over, or blocking
movements. Sensitivity and intrusiveness are thus considered as two distinct dimensions. On the contrary, other studies have identified (a lack of) sensitivity at the core of maternal intrusiveness in PPD (Cohn et al., 1990; Campbell et al., 1995). In addition, some studies have marked “eliciting behaviours” as intrusive (e.g. Field, 1977; Field, Healy, Goldstein, & Guthertz, 1990), whereas others have considered those behaviours as non-intrusive, resulting in a general confusion across studies on how to interpret findings on the mothers’ behaviour (Cohn et al., 1986). These inconsistencies highlight a general lack of clarity on how to conceptualise and measure intrusiveness in clinical research, as also pointed out by Stern (2002), and the employment of behavioural categories that are too vague and not theoretically validated.

Another critical point has emerged out of current behavioural categorisations. Although inspired by the Mutual Regulation Theory, implying that each behaviours only acquires meaning in relation to that of the other, intrusiveness has been identified through single actions such as touching, pulling, tickling as coding indexes per se, regardless of the ongoing interaction and the infant’s behaviour. Aspects of mutuality and reciprocity of early interactions are completely lost in this picture, making intrusiveness a weak compass for exploring successful and flawed dynamics between mothers and infants.

Finally, mainstream descriptions of intrusiveness do not consider contextual elements contributing to define the framework in which the interaction develops. Early social games played by mothers and infants as early as 3 months, for instance, seem to have remarkable variance in their structure, the amount of physical contact by the mother, the infant’s position and the possibilities for her to move (Fantasia et al, 2014). During these games the mother is continuously pulling, poking, shaking, holding the infant’s hand, and the infant enjoys it. Yet, there is no doubt that these behaviours are not ‘intrusive’ if
intended in a negative or disruptive way, but rather functional to entertain the infant.

In light of these critical points, the present study aims at investigating whether intrusiveness, as it has been defined so far, 1) is a valid and reliable behavioural category; 2) has analytical power in observing how different maternal modes of organising the interaction configure opportunities to participate for infants.

5.2. Method

Five interactional episodes involving four 3-months-old infants and their mothers were selected for this study. These data were part of a corpus of more than 40 videorecordings, collected at the University Clinic of Heidelberg by Corinna Reck and her colleagues in 2011.

The original study

The original study by Reck et al. (2011) included a sample of 28 German mothers with current depressive disorders (all diagnosed according to the ICD-10⁹) and their 3-months-olds infants (17 male and 11 female infants) receiving inpatient treatment at the mother–infant unit of the psychiatric University Hospital in Heidelberg. Data from a second group of 34 non-depressed mothers and 3-months-olds infants (24 males and 10 females) were also collected. Infants in both groups were healthy at birth, with a gestational age of no less than 36 weeks. Mother and infants dyads were observed in the clinic research laboratory. The experimental procedure was based on a face-to-face still-face paradigm.

⁹ICD-10 is the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD), a medical classification list by the World Health Organisation (WHO).
(Tronick et al., 1979; Weinberg et al., 2006), were infants sat in a babyseat facing their mother, also seated. The procedure consisted in three episodes, each lasting 2 min: an initial face-to-face episode followed by a still-face episode and a reunion episode. The Infant and Caregiver Engagement Phases (ICEP, Weinberg & Tronick, 1999; see above for a more detailed description) was used for coding mother and infant behaviour. Results showed that dyads with depressed mothers presented higher proportions of negative engagement, described as withdrawn, intrusive and hostile behaviours. More information about these data can be found in the paper presenting the original study.

The present study

The selection of the five episodes involving the four dyads (two clinical and two non-clinical), followed a phase of intensive video observations; the episodes chosen presented similar maternal behaviours (e.g. episodes 1 and 2, and episodes 4 and 5) and behaviours that would fall into the current definitions of intrusiveness (episode 3). Initially, each episode was observed and transcribed by two researcher blind to the mother’s status (depressed or non-depressed). Then a sequential microanalysis of each episode was developed focusing on aspects of both the mother’s and infant’s conduct, including affective expressions, movements, posture, vocalisation and gaze, and the way these were organised into sequences of turns, pauses, repetitions.

All the selected episodes were analysed using the ELAN software, which allows the simultaneous transcriptions of behaviours of both the mother and the infant on the same timeline. Participants have been given fictional names to ensure confidentiality (Table 5.1.)
Table 5.1. *Names and episode number for each dyad*

<table>
<thead>
<tr>
<th>Name of the Mother</th>
<th>Name of the Infant</th>
<th>Episode number</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jenny</td>
<td>Jack</td>
<td>1</td>
<td>Clinical</td>
</tr>
<tr>
<td>Clare</td>
<td>Charlie</td>
<td>2</td>
<td>Non clinical</td>
</tr>
<tr>
<td>Sara</td>
<td>Jim</td>
<td>3 and 4</td>
<td>Clinical</td>
</tr>
<tr>
<td>Amy</td>
<td>Mike</td>
<td>5</td>
<td>Non clinical</td>
</tr>
</tbody>
</table>

5.3. Microanalysis of Mother-Infant Interactions

**Alignment and persistence**

*Episode 1*

The first part of the microanalysis explores two dimensions of the interactional dynamics between mother and infant: Persistency (i.e. repeating a behaviour for a considerable amount of time regardless of the other’s behaviour) and alignment (i.e. behaviour is changed and adjusted according to the other’s behaviour).

Episode 1 begins with Jack and Jenny at the end of a 3.5s coordinated sequence of circular arms movements. The mother is leaning forward snapping her right hand fingers while moving the arm, and the infant is performing similar movements with his left arm (Figure 5.1a). At the end of this sequence, Jack starts retreating his left arm from the coordinated activity, while Jenny continues snapping her fingers at the infant’s eye level. Then the infant vocalises and brings his left hand into the mouth; the mother reacts with a vocalisation of a similar tone (“ah hha”) but remains in a leaning posture and keeps
snapping the fingers very close to the infant’s eyes (Figure 5.1b). In terminal overlap with the maternal vocalisation, Jack covers his face with both arms and wipes his eyes until his body is completely folded in and turned on to the right side of the seat with eyes closed (Figure 5.1c).

**Figure 5.1. Jack and Jenny**

Jenny keeps smiling and continues with her movements, until Jack looks at her and vocalises with a more cry-like sound compared to the previous one (Figure 5.1d). At this the mother stops the snapping and turns from smiling to a facial expression of concern, vocalises again with a corresponding tone (“uo oo”). She escalates the level of her stimulation even more and touches Jack’s hands and chest. The episode ends with Jack frowning, keeping his body folded while the mother is still touching him on the chest.

This episode shows that, while the mother is responsive to one type of Jack’s action (i.e. responding contingently to the infant’s vocalisation), she does not pick up the general configuration of his behaviour; Jenny responds to the infant’s shift to a different interactional modality (voice) by both vocalising after him and reinforcing her snapping
movements, without read Jack’s changes in vocalisation and posture as a withdrawal, or sign of a possible distress. Jenny’s affect in reaction to the first change in the infant’s behaviour (when he retreats the arm and starts mouthing the hand) lacks attunement with the affective downward shift displayed by the infant. When she eventually aligns with his affective state after his distressed cry it is too late to restore a reciprocal interaction.

The succession of movements by the mother appears repetitive and not modulated, with no clear distinction of structural elements, such as opening and closing, or space for transitions created by clear-cut turn formats. The patterns of mother’s movements does not allow for the infant’s initiating or complementary moves, so he can only withdraw from the interaction or communicate discomfort outside the main interactional line (as he indeed does).

**Episode 2**

Episode 2 describes a mother, Clare, also using her hands to entertain Charlie, her infant, yet the structure and affective tone of this dyad’s interaction differs from the one described above. The episode begins with the mother moving the right hand close to the infant’s leg, vocalising with an interrogative tone (single utterance not understandable) and a rather furrowed face. Charlie, neutral up to that point, suddenly smiles broadly as Clare vocalises, just before she turns into a silence of 0.44s. The infant then bursts out into a loud laughter (Figure 5.2a), to which the mother immediately responds to with further laughter accompanied by a verbal confirmation (“hi ya ah”), and head nodding (Figure 5.2b).
After this, Charlie keeps laughing and thrashing arms, and shows an accentuated facial expression of mouth broadly opened, which is similar to that of the mother. The mother then continues to move her hand and head until the infant signals an affective downgrade, moving from laughing to smiling (Figure 5.2c). Thus, she makes another brief pause of approximately 0.3s, during which Charlie yawns briefly and then smiles (Figure 5.3a). This second pause is a contingent response by the mother to Charlie’s early sign of withdrawal which allows the infant to have a break from the interactional stimulation.

After this first sequence, the mother resumes the hand movements, increasing the amplitude of her movement and accentuating her facial expressions. Yet, this time Charlie does not laugh, but keeps smiling for less than a second and then yawns again (Figure 5.3b). He then starts clasping his hands and brings them into the mouth (Figure 5.3c), with a frowning face. At this, the mother makes a short pause, and then touches the infant’s

Figure 5.2. Charlie and Clare, part I
hand. Charlie then gazes away and the mother stops moving the hand, and backs away.

**Figure 5.3.** Charlie and Clare, part II

In this episode Clare uses different multimodal resources in a consistent way to engage the infant. The interactional sequencing involves pauses which may represent transitional spaces, where turns can pass on. The episode is organised in brief strings of multimodal activity, each followed by a pause. The infant’s behaviour seems to happen in terminal position with the mother’s action, and the mother’s subsequent action shows adjustments according to Charlie’s level of intensity and his general behavioural configuration (such as facial expressions, quality of movements, vocalisations). For instance, Clare’s second pause happens when Charlie had decreased his level of activity and started yawning. In other words, the level of activity is adapted to the infant, as the mother shows online adjustments to match the infant’s behaviour. From there, the dyad can negotiate whether to go on within the same activity or change it.

The mothers presented so far may well be described as equally intrusive according
to the current descriptions of intrusiveness, as they both occupy the infants’ space with their hands and body. Yet, fundamental qualitative differences have emerged through the microanalysis, in the way actions are patterned into sequences or turn formats, and acquire different meanings in relation to their temporal and affective quality, such as contingency, persistence, and consistency. Clare’s behaviour can be described as “dialogic”, as she organises the interaction in short turn-like formats, constructed by acting upon the infant’s behaviour and incorporating it in multimodal sequences of action (Berducci, 2010). In this way the infant is embedded in the interaction as an agentive participant in a co-constructed exchange. On the contrary, Jenny’s behaviour may appear rather “monologic”, as the interaction is not modulated on the infant’s behaviours, neither patterned in turn-taking sequences with a narrative excursion (Brazelton, Koslowski & Main, 1974; Ratner & Bruner, 1978).

*Episode 3*

Episode 3 presents Sara interacting with her infant (Jim) by rocking the babyseat on which Jim is seated. A few seconds into the rocking movements had been successful in catching Jim’s attention, who then started looking at the mother. At the beginning of the selected episode, the infant and the mother are both smiling at each other while the babyseat is rocked back and forth (Figure 5.4.).
After approximately 2s Jim starts waving his right hand reaching out towards the mother while looking at her (Figure 5.5.). Sara does not respond to this initiative and keeps moving the seat, smiling. The infant holds this position for almost one second, although the bouncing thrust produced by the rocking movements makes it more difficult for him to do so. Then, Jim shifts his facial expression from a smiling face to a neutral one, and he then starts to lift himself up by moving the chin and shoulders forward (Figure 5.6.).

Figure 5.4. Jim and Sara at the beginning of the interaction

Figure 5.5. Jim reaches out with his arm
The infant goes on making the same movements of coming forward with raised hand, for approximately 3” since he raised his hand for the first time. Sara ignores this move by Jim and continues with the same rocking movements and a smiling face. Then, with a brisk movement, she holds Jim’s wrists and start to pull him up.

![Image](image_url)

**Figure 5.6.** Sara keeps rocking the baby seat

Although by rocking the seat the mother shows a rather creative way of entertaining the infant (given the limited possibilities offered by the face-to-face situation), she misses the opportunity to change the content of the interaction by re-using the infant’s behaviour. Indeed, Jim’s behaviours display that he is disattending the mother’s line of action to introduce a different type of action (and affective shift) which is not recognised by Sara. Equally, the affective shifts going from smile to a light frown is not mirrored or responded to. On the contrary, she persists with her movements, which are not sequentially organised or patterned, and make it more difficult for the infant to join in the interaction. Similarly to what we observed in episode 1, a persistent behaviour by the mother, with no intervals or pauses, results in the infant’s disengagement with the main line of interaction. It can be argued that these moves are attempts by the infants to interrupt the current course of action.
by the mother and open a different sequence. Whatever the goal of the infant’s behaviour, it is clear that a turn-taking format keeps the infants “in” and allows them to modulate their participation on the mother’s level of activity, whereas persistency and un-modulation conduce to disengagement and affective misalignment.

Unlike the previous episodes, however, this sequence may not be coded as intrusive, as the mother does not directly interfere with the infant’s activity nor is she invading the infant’s space.

**Sequential structuring and temporal coordination**

In the following two episodes two dyads are analysed as they engage in a series of pulling up sequences. Similar maternal behaviours are analysed to show how differences in terms of participation and alignment do not only depend on the behaviour alone or the temporal coordination, but are rather strictly connected to dimensions of sequentiality and structuring of the interaction.

*Episode 4*

This episode follows the interaction of the dyad described in the episode 3. The mother has just stopped the rocking movements to hold Jim’s wrist and start pulling him up. Yet, the infant seems not prepared for this initiative, and when the pulling movement begins his arms are flat, outstretched but not stiff and the body is laying on to the seat (Figure 5.7.)
The pulling up force is therefore all on the mother’s side. Jim’s head is bent forward, embedded into the outstretched arms pulled by the mother, so that he cannot gaze to the mother. When he is completely lifted up the space between Jim and the mother is still considerably wide and the lifting looks incomplete (Figure 5.8.). Jim now briefly looks at the mother with a neutral facial expression, while she keeps a static smile unchanged throughout the entire episode. The infant quickly shifts his gaze and starts to move back on to the babyseat. His descending movements are brisk and the head is aside, floppy, despite the mother supporting hold. Two more lifting actions follow, lasting respectively 2.5s and 3s, and each coming quickly after the previous one with a brief or no pauses in between. Over each episode the dyad acquires more coordination of movements, and in the last episode Sara starts her pulling movement and takes over the infant’s lifting movement contingently after he had started to lift himself up, resulting in a very smooth transition.
Although increasing their temporal coordination, the interaction still appears as unsuccessful, as the mother’s keeps smiling while the infant shows a neutral face and seems rather passive, so that their affects are not aligned. The level of activity is not shaped on the infant’s affective state or behaviours, nor is it modulated by increasing or decreasing activity. The fast succession of lifting sequences, one straight after the other, is not organised in patterns of action spaced by intervals and presenting a clear narrative-like structure. Sequences of lifting have not clear boundaries which distinguish, for instance, the opening of the action to the closing, resulting in a series of movements that have no excursion or evolution.

**Episode 5**

In this episode a dyad (Mike and Amy) is engaged in a lifting up sequence similar
to the previous one. The interaction starts with Amy noticing some lifting attempts by Mike, and verbally inviting him to do so ("Oh, willst du aufstehen?"; tr. "Oh, would you like to come up?") (Figure 5.9a). Mike, whose gaze was away, now looks at the mother, smiles and starts to lift up first the legs and then the rest of the body. Sara responds to this initiative by upgrading the level of stimulation by laughing and with a verbal confirmation ("ah genau!"; tr. "ah, yes!"), and starts to pulling up the infant (Figure 5.9b).

**Figure 5.9. Mike and Amy, part I.**

The lifting proceeds with reciprocal gaze and smiling (Figure 5.9c), until Mike is at his maximum lifting eight and so close to Amy’s face that she gives him a kiss on the forehead (Figure 5.9d). In terminal overlap with the mother’s action, Mike slowly moves back in to the babyseat. Before the infant has completed his return to the seat, the mother anticipates the completion of the sequence by saying “Super”. A brief pause follows, in which the dyad gazes reciprocally until the mother makes a second invitation by asking Nochmal? (“Again?”), and projects the next action forward by counting Eins, Zwei, Drei (“One, two, three”). She then starts pulling Mike up into a new lifting. After this, three
more lifting sequences follow, each spaced out by pauses (lasting approximately 1s).

In its last lifting the dyad is well coordinated in negotiating the closure of activity. The action begins with the mother vocalising through accentuated opening movements of the mouth, immediately mirrored by Mike (Figure 5.10a).

![Figure 5.10. Mike and Amy, part II.](image)

After approximately 0.8s, while the infant is still moving his mouth, Amy stops vocalising and starts pulling Mike up. He starts lifting with a slight delay. While Mike is still lifting up, Amy anticipates the completion of the action with a kiss on the infant’s forehead (Figure 5.10b). When the lifting is completed and Mikes is completely up, the mother’s kissing action is almost finished. The infant then quickly moves back on to the seat. While retreating, Mike does not look at the mother and put his hand into the mouth. The interaction closes with both participants displaying a neutral face (Figure 5.10c) and no further actions.

Similarly to episode 4, the coordination of movements in this dyad increases over
time. However, in this interaction the mother encapsulates each lifting episode into a defined event with an opening and closing. In the first lifting, for instance, she does it by counting down (“one, two, three”), and verbally invites the infant (“do you want to come up?). She then marks the completion of the action with a kiss on the infant’s forehead, which functions as anticipatory contextualisation (Mehus, 2011) for the closure of the sequence. In the first sequence, the lifting closed with a comment by Amy marking the interactive success (“Super”, 0:10.81). This happens in each lifting of the sequence, with very minor changes between one lifting and the other, and leads the way for the next lifting action. On a broader perspective, this episode shows two different temporal levels as described by Kaye (1979): A level in which actions run horizontally over time represented by, for instance, the reciprocal gazing, and a vertical level, hierarchically organised, in which actions are nested. In this way the mother provides a frame with her sequencing of the interaction containing the infant’s behaviour, and at the same time creates moments of affective mirroring. A coherent dynamical interplay between these two levels may support (or constrain) the infant’s participation in everyday routines, transforming sequences of action in enjoyable moments within a clear, predictable structure.

Although the activities of the two last episodes may appear similar, considerable differences disclose through the microanalysis. Coordination of both dyads increases over the course of the episode, as each lifting results smoother than the previous one and better physically adjusted. Nevertheless, in episode 5 the mother acts upon the infant’s initiative to lift himself up, so that the infant can participate in the interaction that, in a way, he has himself proposed. On her side, the mother organises the interaction in sequential micro-episodes presenting clear boundaries (e.g. opening and closure) and pauses in between. These boundaries are signalled to the infant through increasing and decreasing intensity of
activity (increasing or decreasing tone of voice, acceleration or deceleration of movements), upgrades of affective tones and the different use of communicative modalities, (e.g. a kiss to mark the end of the lifting, or the verbal preparation for the lifting). Altogether, these micro-episodes evolve and unfold into a narrative-like sequence, in which motor and affective coordination increases over time and ends with both the partner disengaging from the interaction.

In episode 4, instead, we saw that the beginning of the sequence is not marked, and as a result, the infant appears not ready for the lifting in the first sequence. Furthermore, there is no evolution of the interactive quality in this dyad, except for the temporal coordination which increases over time. The lifting sequences are constructed over a single resource (physical movements), resulting less entertaining for the infant and less enjoyable overall. Finally the mother does not immediately pick up the infant’s initiative to change the interaction.

5.4. Discussion

The present work aimed at rethinking the concept of intrusiveness by exploring the consistency of its behavioural descriptors, and its efficacy in capturing the interactional dynamics which may restrict the infant’s participation in interaction. To begin with, attention was drawn to issues regarding the consistency of categories describing maternal intrusiveness, which are 1) the lack of a general agreement about definitions and coding models; 2) a progressive distancing from the Mutual Regulation theory, on which most of the current descriptive categories are based; and 3) the pitfall of assigning a pre-defined meaning to single behaviours without considering the context in which they occur. This
study aimed at further exploring these issues, analysing in depth examples of behaviours that would fall under the intrusive or non-intrusive category according to ICEP, a coding systems currently used in postpartum depression research (see section 5.1.).

From the analysis of episodes 1 to 3 two dimensions have been identified, which discriminate between interactions apparently involving the same type of macro-behaviours (e.g. waving hands or pulling the infant up). The first one is persistency, defined as repeating a movement or action for a considerable amount of time regardless of the other’s behaviour. As emerged in the microanalysis, persistent behaviours appeared linked to a general difficulty in recognising the infants’ signals, in terms of affective shifts or initiatives. In this sense, these behaviours lacked of reciprocity and failed to acknowledge infants as agentful partners, limiting their possibilities for interacting. In this sense, it is not surprising that episodes characterised by persistent behaviours lasted shortly and were often affectively unsuccessful, resulting in the infants disengaged from the main interactional line, either by physically retreating (episode 1) or through affective dis-alignment (episode 3).

Contrarily to persistency, alignment seemed to be an essential positive factor for the quality and duration of the interaction. Alignment is defined here as reciprocal, online behavioural adjustments to the other’s behaviour, which enabled the mother to respond to the infants’ signals and adapt the ongoing action accordingly. In episode 2, for instance, the mother paused the action after the infant’s yawning, decreasing the level of stimulation and signalling the possibility to a pause from the interaction if needed. This, in a sense, gave the infant the possibility to remain in the interaction with a lower profile, instead of disengage, making the interaction lasting longer. Issues of persistency and alignment were also visible in episodes 4 and 5. In analysing these two episodes concerning two dyads engaged in pull-
up sequences, it was emphasised the role of action boundaries and overall sequential structure in facilitating participation and engagement. These dimensions appeared to be essential for the interactional success, as emerged in episode 5, through a qualitative evolution of the interaction, sequence after sequence, where the series of lifting actions had a narrative-like format – started with an introduction, proceeding through an intense phase and then concluding on a slower and less animated action level. Each sequence in this episode presented repetitions (the kiss on the infants’ forehead), pauses and clear marking of boundaries for opening and closure which supported the infant’s participation by creating interactional space.

This evolution was instead missing in episode 4, where the only progress concerned the temporal coordination in the lifting/pulling movements. Indeed, in this episode actions were not sequenced and divided by recognisable boundaries and intervals, leaving no slots in which the infant’s action could be placed. In other words, the infant had no affordances for moves in the same activity domain of the mother, and thus no chances to actively influence the caregiver’s action.

Overall, the microanalysis revealed that maternal behaviours were similar on the surface, but differed when more subtle dimensions of behaviours were considered dynamically, in their evolution over time. These dimensions highlighted that the description of behaviours as intrusive per se was not significant nor sufficient for understanding the interactional dynamics between the mother and the infant, as actions never happened as single instances. Rather, maternal behaviours were patterned into sequences of multimodal actions, often in the format of turn-taking, that presented a defined excursion and duration with respect to what the infant was doing. Looked from a temporal perspective, these behaviours presented a variety of aspects that facilitated or restricted the infant’s
participation as well as the general affective outcomes. These observations are in line with previous findings of infant research, showing, for instance, how interactive turn formats are grounded in the maternal sensibility to detect and align with the temporal variations of the infant’s behaviours (Brazelton, Koslowski & Main, 1974; Kaye, 1977).

It is important to stress here that this study did not aim to compare two populations (i.e. depressed versus non-depressed mothers), but rather to unpack the interactional dimensions at play in episodes identified as intrusive under mainstream descriptions. Although evidence from the microanalysis suggests that the most marked difficulties in aspects of sequentiality, alignment and timing appeared to involve dyads with postpartum depressed mothers, at the same time none of the behaviours observed across dyads was intrusive in itself. Even the mother’s persistent snapping of the fingers, observed in episode 1, was not problematic as a movement *per se*, but in its dis-alignment with the infant’s behaviour over time. This suggests that current descriptions of intrusiveness as pre-defined, individual behaviours might be not discriminative enough in investigating early mother-infant dynamics. Furthermore, given the evidence that results on intrusiveness in PPD are inconsistent and contradictory, a more-naturalistic and observational approach to mother-infant dynamics, were mothers have the possibility to engage in fully completed activities using a variety of resources available (e.g. toys) may help to clarify the influence of PPD on infants’ development.

Additionally, the way intrusive behaviours have been coded so far seem to assume that all maternal behaviours are initiatives (such as cutting across or interrupting the infant’s action) (Beebe, 2006; Goodwin & Heritage, 1990; Ochs, 2012), but the microanalysis presented in this work has demonstrated that this was not the case. Most of the behaviours identified as intrusive by mainstream research, on the contrary, are
necessary *manoeuvres* to commence a new action, or to respond to the infant’s initiative (as in episodes 3 and 5). Additionally, actions such as holding the infant’s hand, pulling, physically invading the infant’s space or interrupting an ongoing action are part of the way everyday situations are accomplished and regulated by adults, who perform actions with and on infants, without whom infants would not survive.

This study has therefore challenged the usefulness of considering sets of single behaviours pulled together in a general category to label the appropriateness of maternal conducts in clinical population. Indeed, as strongly suggested by previous research on language development and socialisation (Ochs & Schieffelin, 1984; Bateson, M.C., 1994; Duranti, 2000), the same maternal behaviour may assume completely different meanings and functions according to the sociocultural norms and nurturing practices and the specific maternal style (Mead & MacGregor, 1951; Schieffelin & Ochs, 1986; Keller et al., 2004). Recent findings have revealed cultural variability in the temporal organisation of mother-infant interactions in terms of length of intervals, overlaps and use of nonverbal resources, and how these aspects are dynamically affected by changes in the living contexts (i.e. migration) (Gratier, 2003). Any definition of single maternal behaviours as non-appropriate or intrusive should take this aspect into account.

To conclude, current definitions of intrusiveness encompass a range of behaviours that restrict or reduce the infant’s interactive participation. This study has demonstrated that specific aspects of the maternal organisation of the interaction – sequentiality, alignment, persistency and temporal coordination - play an essential part in supporting the infants’ interactive agency and participation. Clearly, it is not possible to ignore that these aspects were played differently by the mothers with postpartum depression observed in this study. Yet, this may be due to a variety of factors, including the pressure of the experimental
condition, which may have induced PPD mothers to overstimulate the children or keep an ‘upbeat’ attitude throughout.

Whether these interactional patterns characterise mothers with psychological difficulties more than non-clinical mothers, and whether they extend over the first months of the child life is for further research to establish. Will there be a chance for these dyads to develop successful communicative interactions, even if they were relatively unsuccessful at an early stage? The differences in shaping actions boundaries and sequential developments identified in this study may be worth exploring in further research in clinical populations.

5.5. Conclusions

The present work does not aim to devalue the considerable work done by researchers in the past, especially in postpartum depression. Furthermore, the limited number of observations does not make it exhaustive. However, the sequential and multimodal analysis inspired by Conversation Analysis, including recent development in infant research (Berducci, 2010; Nomikou & Rohlfing, 2011) appeared to be powerful in discriminating between characteristics of behaviour that may impact on the child’s behaviour in different ways, thus gaining a more subtle understanding of different types of dysfunctional interactional patterns that may occur. Thus, the present study may be considered a step on the way to the development of new conceptualisations, ethnomethodologically oriented, that would inform the theory and method of future research.
References


Weinberg, M.K., Olson, K.L., Beeghly, M. & Tronick, E.Z. (2006). Making up is hard to do, especially for mothers with high levels of depressive symptoms and their infant
6. GENERAL CONCLUSIONS

The studies presented in this thesis aimed to explore how infants become cooperative participants in contexts of natural co-actions with their caregivers, through a non-inferential view on cooperation. The problem of “representation” was therefore transformed into the analysis which allowed for a deeper understanding of the dynamic vitality and signals that make cooperative living and acting possible. To do so, a look beyond current definitions was needed, to explore instead the contexts and modalities in which individuals (and not only infants) negotiate their participation by interacting. The notion of participation has been largely used through several disciplines inspired by the concept of participation framework proposed by Goffman (1981). Within Conversation Analysis, the issue of participation has been revisited within an embodied perspective (Goodwin & Goodwin, 2004; Streeck, Goodwin & LeBaron, 2011; Goodwin, 2013), revealing its dynamic, changing and complex organization, as well as the importance for its organization of multimodal resources, specific formats, and changing configurations.

A theoretical shift was therefore endorsed in the works presented in this thesis: from cooperative actions defined as a set of interlocked, predefined actions performed under a clear agreement on goals and roles, to a view of cooperating as an intrinsic part of any interactional process. A process that involves participation, implying that the range of possible cooperative activities depends on many different factors at play, such as the characteristics of participants and their relational history, the social context within which they move and the complexity and nature of the task. This redefinition was first laid out in
the (very cooperative!) work with Hanne de Jaegher (chapter 2), where the spectrum of ways in which individuals participate in cooperative encounters was broadened to take into account formal encounters in which two or more people explicitly agree on a task and roles, to everyday situations were individuals implicitly or naturally contribute to the each other’s actions, e.g. to make space on a very crowded bus for someone that wants to get in. In line with the Conversation Analysis view, the work proposes that any social interaction presents intrinsic cooperative aspects, in its being a practice of making sense of the other with the other. Interactors are not contributing to a shared goal by simply placing their pre-defined or pre-agreed individual contribution; rather, they are dynamically co-participating in the definition and building up of that shared activity.

Integrated with previous research on the development of language and socialisation (Kaye, 1979; Trevarthen, 1979; Ochs & Schieffelin, 1984, 1995; Berducci, 2010), this new perspective has enabled exploring cooperation in infancy as a dual process: on the one hand, infants naturally participate in, and actively support, joint activities, part of which are the daily routines for their care and entertainment; on the other hand, joint activities are also learning contexts, where infants make experience of and develop cooperative participation. What makes this dual process possible? Three aspects were identified and discussed in the studies presented in this thesis as particularly important for the development of participation in joint routines: The interactional organisation, multimodality and predictability. Each of them is connected to the other two but also representing an influential factor in its own right.
6.1. Interactional organisation

Learning to participate in social interactions is a complex process, fundamentally related with the emergence of communicative skills. The practices and contexts of language acquisition have been studied in the forms of units of participation (Duranti, 2000) and the relations between communicative strategies and social organisation (Ochs, Schegloff & Thompson, 1996). It has been proposed that language reflects aspects of the social order (M.H. Goodwin, 1990), that is, the way in which a conversation is organised enacts modalities of social organisation. The interactional organisation (or design) of early caregiver-infant interactions such as sequentiality, turn-taking, contingency and timing regulate the infant’s participation: the rhythm and organisation of feeding cycles, for instance, are negotiated in turn formats which take into account the infant’s initiatives and pauses as well as those of the mother (Kaye & Brazelton, 1971).

Play interactions in older infants (between 5 to 9 months of age) appeared to have a clear turn-taking structure, finely patterned and embedded in a temporal evolution (Watson, 1972; Stern, 1974; Ratner & Bruner, 1977). Our study on play routines (chapter 3) showed that earlier forms of play routines, such as nursery-rhymes, are designed to entertain infants by acting with and upon them (Berducci, 2010), e.g. where the mother jointly claps her hands with those of the infant. In doing so, mothers physically sustain the infant’s participation by enacting and incorporating it into the interactive sequence.

The microanalysis of face-to-face interactions presented in chapter 5 revealed that mothers engaged the infants in sequences of turns and pauses even in a situation with limited resources (no toys available, very little space for movements), which supported the mutual participation. Most surprisingly, these interactions also appeared to share some
aspects of the “conversational grammar” used by adults in conversations, e.g. in the way patterns of actions and gaps are organised.

6.2. Multimodality

Multimodality, described as the simultaneous use of different communicative resources, Lerner et al., 2011) appeared to be an essential feature in promoting and sustaining infants’ participation in the joint routines investigated in this thesis. The microanalysis of mothers’ and infants’ behaviour in chapter 5 showed that some configurations of motor and vocal actions constrained or facilitated the infant’s contribution to the interaction. However, even when these two modalities were not used simultaneously but in succession, they functioned as key elements in creating an interaction space for the infant. For instance, vocalising “one, two, three” before the beginning of the lifting action, the mother allowed the infant to ready himself for the next action. Furthermore, the ability to switch from one modality to another (e.g. from singing and gesturing to talk) appeared to be an effective strategy that mothers used to regulate the level of stimulation and align to the infant’s state.

Results from our study on early play routines suggested that the multimodal performance of early play routines was a key element to make the games successful and entertaining, but also recognisable by the infants. When the vocal and kinetic resources were separated and the games performed unimodally, the infants’ motor and affective participation decreased. Most surprisingly, this happened regardless of the mothers’ accentuated attempts to maintain an affective engagement with the infant.
6.3. Predictability

A central aspect of mother-infant routines is their being repetitive and with a recognisable form across different environments (and different resources available), making them largely predictable for the infant. The findings presented in this thesis revealed two aspects of predictability: 1) single movements, gestures, vocalisations or multimodal combinations of them appear repeatedly within the same sequence or sequences in interactions. For instance, two out of three social games observed in chapter 3 presented the same combination of gestures and vocalisation at the beginning and end of the game; 2) structural aspects organise the joint routine into a narrative-like format, presenting clear opening and closing phases and a peak of activity in the middle. This format makes the interaction more predictable, as it enables the recognition of each phase as they unfold and the anticipation of the next one (Fasulo, 1999). These structural aspects allowed the games to maintain a close temporal structure despite the mode of presentation. Chapter 5 presents a nice example of a mother-infant engaged in a series of lifting sequences (visibly structured in a narrative format) which become increasingly coordinated and synchronised after each repetition. The results presented in chapter 4 as evidence of infants’ participation in pick-up interactions also seems to suggest that joint routines enable infants not only to predict the mother’s behaviour, but also to complement and support it through specific functional actions.

As Bruner (1985) has proposed, formats of actions become increasingly conventionalised over time, and develop in ways that are less idiosyncratic and more recognisable. The combination of the three aspects just described – the interactional organisation, multimodality and predictability – contribute to the process of
conventionalisation, that is, the way infants learn to anticipate when and how a partner’s behaviour will change and the intrinsically cooperative dimension created by mutually attending to and “commenting on” the same object (Kaye, 1979; Bruner & Sherwood, 1981).

6.4. Understanding and sharing intentions

Mainstream accounts of cooperation have claimed that shared intentionality, broadly defined as mentally inferring the other’s intention in a joint action, is at the very basis of the ability to cooperate. As argued in chapter two, these approaches have explained shared intentionality from an observer’s perspective, but not from a participant’s one. Observers have to make inferences about others’ intentions or motives, but participants or co-actors directly perceive what the other is aiming to as recipients of the action under way. Participating in the same activity, attending to each other’s movements, vocalisations or gaze is enough to make other’s actions (and the intentions behind them) unambiguous.

What is the role of joint routines in the development of intentionality? As already argued, the familiar and repetitive character of early routines makes the caregiver’s behaviour predictable. Previous studies have shown that infants can understand and anticipate other’s intentions-in-action, naturally complementing or supporting it (Reddy et al., 2013). The same seems to be true in familiar routines. As suggested by the findings presented in chapter 4, the mother’s intentions to pick the infant up are visible in the dynamical sequencing of her movements, from approach to lift. Infants’ contribution to the action is therefore not so much informed by the identification of intentions, as by the recognisability of emergent structures of action-in-progress. As Mehus (2011) suggests,
“caregivers are not operating with the assumption that the intentions that underlie [young children’s] action are stable and independently existing, but rather seen them as (...) resulting in differently understood acts” (p. 133).

Shared intentionality may therefore be reframed in light of the assumption that 1) intentions are visible and embodied in actions and 2) interactions are conceived as mutually constructed and dynamically shaped by each participant’s action. Under this view, intentions are shared and co-constructed just as interactions are, emerging out of social (cooperative) interactions, rather than being a prerequisite for their occurrence.

Thinking about intentions and shared intentions as acts, rather than mental, individual objects, allows us to explore the developmental processes within which infants learn to make sense of others’ behaviours and interact with them. In these “conversational negotiations” (Trevarthen, 1998; Trevarthen & Aitken, 2001) infants find their motives for participating in social interactions, namely, cooperating.

6.5. Conclusions

To summarise the main findings presented in this thesis, early joint routines appeared to be places where cooperative participation is practiced and learnt, even before the development of inferential abilities. This is possible because infants interact with caregivers in socially organised contexts. The sequential and turn-taking structure of these contexts constrains, reduces or facilitates the possibilities for infants’ participation, preparing the ground for later, more complex forms of interaction and communication. Overall, this thesis suggests that the observation of infant behaviour in daily, familiar practices, such as joint routines,
may reveal aspects of infants’ participation as competent and functional, which may not otherwise be observed in other (more artificial) contexts.
References


